CIVIL DEFENCE AND THE ATOM BOMB

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CIVIL DEFENCE AND THE ATOM BOMB

There are defences against atom bombs

Anyone who thinks that there is no defence against an atom bomb is wrong.

The destructive power is obviously enormous, but even so its effect is limited. Outside the hardest hit area there will still be tens of thousands of lives which can be saved by shelter and strong Civil Defence services.

Their range of destruction though great is definitely limited

Most people judge the effects of an atom bomb by the damage caused by the two dropped on entirely unprepared populations at Hiroshima and Nagasaki.

It is not generally known, however, that in the city of Hiroshima, over half the people who were within a mile from the atomic explosion are still alive. At Nagasaki nearly seven out of ten people within a mile from the bomb lived to tell their experiences.

Even should more powerful bombs be developed, we must remember that doubling the power of a bomb would only extend the range of damage by a quarter. In the same way if there were ever a bomb 100 times as powerful, it would reach out only 4 or 5—not 100—times as far. (MEAN YIELD OF 23,335 NUCLEAR WARHEADS = 274 KT.)

There is some protection against all the destructive effects of atom bombs

To understand how human life can be protected against atomic attack, it is important to realise how any form of atom bomb does its damage.

The enormous energy released from the explosion of an atom bomb takes three main forms. These are radioactivity, heat and blast; against each of these there is protection.

Even an ordinary house gives valuable protection against radioactivity

Radioactivity takes the form of gamma rays and of radio-active particles into which the bomb splits up. Nuclear particles called neutrons are also given off, but these penetrate only to a relatively short distance where other effects are also very intense.

Gamma rays are dangerous up to 1½ miles from the centre of the explosion and would certainly be fatal to those within ½ mile radius unless they had some form of protection. Gamma rays do not make the materials they strike radio-active. They are given off only for a few seconds after the explosion. Against gamma rays, the walls of ordinary dwelling houses would afford a definite though limited degree of protection. Shelters of the last war standard would do more, trench shelters providing a very substantial degree of protection, and in all cases the protection given can be much increased (so far as gamma rays are concerned) by extra thickening of the roof and all sides of the shelter.

If an atom bomb is exploded well above the ground to give maximum damage by blast and maximum casualties by heat and gamma rays, there will be no other serious radio-active effects. With low bursts radio-active particles of dust into which the bomb splits up might cause lingering radioactivity on the ground, but this can be detected and measured by instruments and the contaminated areas marked off. Moreover, the contamination is not likely to last long.

Light materials will protect against burns from heat flash

The heat flash—the second of the main forms of energy released by the bomb—can ignite combustible material up to nearly two miles from the centre of damage. It can also cause death or serious burns within a radius of at least a mile among people who are not protected in any way. But even thin materials, like blinds or curtains (though they may themselves catch fire, especially if they are dark coloured) can give substantial protection to human beings.

Shelters give good protection against blast

The blast of an air burst atom bomb of the same power as that dropped on Nagasaki would damage houses up to a distance of 2 to 2½ miles from the point immediately under the burst. But over most of this area framed buildings would give considerable protection, and shelters of the last war standard would give good

protection, against atomic blast. It was found at Nagasaki that a number of small shelters well covered with solid earth survived within 300 yards of the centre of damage.

Planning for shelter is well advanced

To ensure that resources when they become available for shelter are applied to best advantage, careful planning is essential. For this purpose local authorities for areas considered likely to be targets for attack have been asked to survey their areas, to assess the amount of additional shelter needed and to formulate proposals as to how it will best be provided. This planning is well advanced.

Strong Civil Defence services are needed for many purposes

The evacuation of mothers and children from likely target areas to places of safety, the issue of respirators and the organisation of the best use of available shelter are necessary precautions to be taken if war or attack seems imminent, but large numbers of men and women will be needed to carry these measures through successfully.

If air attack does come, fire will be one of the greatest dangers from either atom or high explosive and incendiary bombs. Well manned, well trained, well equipped Fire Services can get this danger under control or at any rate very considerably limit its destructive power.

Casualties among those trapped in wrecked buildings will be greatly reduced if there are numerous, well trained rescue parties to extricate them. If the wounded can be tended speedily and removed to hospital, their chances of quick and successful recovery will obviously be much greater. But this is only possible if men and women are available to perform these services.

Much can be done for those who have been made homeless, but only if there are many to help.

And finally the essential services, supplying water, electricity, gas and so on must be restored as quickly as possible. But those responsible must have adequate numbers to help them.

This means that volunteers are needed to train now for the Civil Defence and Allied Services: the Civil Defence Corps, the Auxiliary Fire Service, the National Hospital Service Reserve and the Special Constabulary.

ISSUED BY THE HOME OFFICE & THE SCOTTISH HOME DEPARTMENT

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RESTRICTED

HOME OFFICE

Japanese Civil Defence

CIVIL DEFENCE
PAMPHLET
NO. 9

WHY CIVIL DEFENCE FAILED IN HIROSHIMA AND NAGASAKI, WHEN SHELTERS WERE NOT OCCUPIED IN NUCLEAR ATTACKS.

LONDON: HIS MAJESTY'S STATIONERY OFFICE

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1948

FOURPENCE NET

JAPANESE CIVIL DEFENCE

PART 1

1. General

Accounts of Japanese Air Raid Precautions exercises were published in the Japanese papers as early as 1928. As Japan was, at that time, at peace with the world, it can only be surmised what their object was in building up such an organisation. These exercises covered such subjects as gas mask drill, black-out and elementary first aid, reminiscent of the early days of A.R.P. in this country. The weaknesses which showed themselves in the organisation at later dates, could not be attributed to the late set up of the organisation, nor to the fact that it had not been exercised. Its failure was due to the A.R.P. authorities underestimating the scale of attacks likely to be launched against them, as a result of the optimistic appreciation by the Military, who gave as their opinion, "the only raids that could be staged on the Japanese homeland would be of a spasmodic nature involving not more than two or three aircraft and that no bombs of greater weight than 500 lbs. would be dropped." In fact the raids envisaged would be of the tip and run variety. A.R.P. plans were accordingly built up on this false appreciation.

2. Control

(i) GENERAL.—From 1928–1937 civil air defence in Japan was confined—to the six great cities, i.e. Tokio, Osaka, Nagoya, Kyoto, Yokohama and Kobe, but when the National Air Defence Law of April, 1937, came into being (the issue of this law was closely related to the attack on China on 7th July, 1937) Civil Defence became a national programme under the jurisdiction of the Minister of Home Affairs. The history of the development of Civil Defence was marred by confusion, conflicting authority, inadequate and incoherent planning due to the Japanese habit of believing that if one plan failed through lack of proper execution, all that had to be done was to make another plan and all would be well. There were also continual conflicts arising with other Ministries who were indirectly concerned with Civil Defence. The situation was further complicated by the creation in 1939 of two volunteer organisations at national level. The Great Japan Air Defence Association and the Great Japan Fire Defence Association. Both these organisations were designed to give prestige to the civilian defence programme in their respective fields, to act as sponsoring agencies with respect to training and propaganda and to provide financial assistance to volunteer Civil Defence organisations. The situation became, however, so involved that an Air Defence General Headquarters was created in November, 1943 (an example of making a new plan to correct an old one), for the purpose of co-ordinating plans and settling disputes.

This Air Defence General Headquarters was never, however, given sufficient power to be able to integrate the air defence programme, as a result it became a clearing house and planning centre rather than an operational headquarters.

(ii) ADMINISTRATION AND CONTROL. Decrees, orders, etc., issued at national level were often in the most general terms, and the execution became the responsibility of the Governors of the 47 Prefectures in Japan. (An exception to this rule was made for Tokio, see Appendix A.) The prefectural administration adapted the national policy to meet local conditions.

In examining the control of Civil Defence the part played by the police must be understood. All police in Japan are prefectural police, with the exception of Tokio, and exercised a degree of authority over the lives of the citizens which would not be tolerated in a democratic country. As a result, the police became the Government agency for applying the Civil Defence programme to the people. Other prefectural departments were responsible for their own sphere of activity, i.e. Economic Section being responsible for food and other necessities, etc. When the tempo of raids increased the police did not hesitate to take any and all authority deemed necessary to handle the situation. Administrative organisation at Borough and Urban district level took two forms: the ward organisation in large towns and cities and the local organisation in Urban areas. There was, however, close co-operation between municipal and prefectural officials.

The sub-division into wards corresponded, as a general rule, to the area under the jurisdiction of the district Police headquarters and there was a close connection between the police and the ward officials. It was at this level that the influence of the police on the Civil Defence organisation was most directly exercised.

The police also supervised Civil Defence in Urban and Rural areas through police stationed there or by means of visits at regular intervals.

3. Control Centres and Reporting

(i) GENERAL. The organisation of control centres in Japan was for one main control situated at prefectural or police headquarters (Metropolitan Police Board in Tokio), and a sub-control at each unit and sub-unit headquarters of the Auxiliary Police and Fire Services. The necessity of alternative controls was never appreciated, in fact the majority of control centres were not even sited in bomb or fire proof buildings. In some cases, in the early days, control was run from the administrative offices.

(ii) MAIN CONTROL. Main control consisted of a message room, operational room (with large-scale operational maps) and press room. The prefectural governor was the Commander of these headquarters (see Appendix A); operations, however, were controlled by a Civil Defence headquarters commander who was, generally, the head of the police division of the prefectural government. Leaders (or their representatives) of all the air raid services were at this control, with whom

(v) TRAINING. The main duties of the Guard Rescue unit was the rescue of people trapped as a result of air attack, but the shortage of man-power made it imperative that the units should be used on other duties, mainly police, between raids. This situation greatly influenced the training programme. In sub paragraph (iii) the recruiting and selection of members for the unit is set out. It will be seen from this that the general bias of training was towards police duties. It was quite usual to post younger men to the guard rescue unit to enable them to continue reserve police training in conjunction with the rescue training.

The responsibility of the training rested with the chief of the unit. Schools were established in the prefectural police and fire departments, for the instruction of the battalion, company and platoon leaders, who, when they had returned to their commands, were responsible for the training of the personnel.

Technical training was very often given by men with some engineering background who gave lectures and demonstrations. Reports were also made by leaders who had visited other cities to study the training programme there and also studied the operations of the rescue services in those cities that had been bombed.

The army also assisted by making available their engineer schools for the training of leaders in the types and capabilities of the bombs used by the Allied Air Force.

These engineer schools had been established by the army in several prefectures.

The unit had no standard syllabus of training laid down, and whatever rescue training was carried out, it was always sandwiched between the training in and performance of police duties.

Although rescue work was the most important of the unit's work during an air raid the unit was also authorized to aid in road clearance, traffic control, guidance and direction of refugees, prevention of panic and bolsering of morale. Particular attention was paid to the training of the unit in the last two duties.

(vi) CONCLUSION. Investigation has proved that the failure to establish a sound training procedure and the lack of provision of sufficient and adequate rescue equipment prevented the unit from carrying out rescue duties during the heavy raids and thereby caused it to direct almost all of its efforts in fulfilling these auxiliary duties.

DIRECTOR GENERAL'S DEPARTMENT,

HOME OFFICE.

APPENDIX A

Tokio Control

Owing to the conflict existing between the Tokio municipal office, Tokio prefecture, and the metropolitan police board there was a serious disruption in the air defence organisation and planning from 1937-43.

As a result of this conflict on 1st July, 1943, the city and prefectural governments were abolished and their authority combined in a general administration over the entire metropolitan district.

The metropolitan police board had originated in the medieval period. It was a centralised organisation and accustomed to the exercise of broad and ruthless methods in the maintenance of order.

The Tokio police had never at any time taken orders from any administration of the prefectural and municipal level and only considered itself responsible to the national government.

It, therefore, demanded and obtained control over those volunteer agencies (originally created by the city administration) which assisted in actual air-raid defence operations.

The danger was clearly realized, by the Ministry of Home Affairs, in having two separate government organisations in the same district operating in matter of air-raid defence, and an effort was made to define their respective responsibilities in such a way as to prevent duplication and conflict of authority, but no progress was made. Within four months of the setting up of the metropolitan district, a new organisation called the Tokio Civil Defence Headquarters was established.

This new organisation was established to act as a liaison and co-ordinating agency between the police board and district administration. Its duties were to

(i) Define the air-raid defence functions between the various administrative offices.

(ii) Formulate joint plans for air-raid defence.

(iii) Act as a single unified organisation in the direction of operations during raids or national diasters such as fire, floods or earthquakes.

Since the Governor of the metropolitan district combined in his office the prestige previously vested in both the mayor of Tokio city and the Governor of the Tokio prefecture and held a somewhat higher government rank than the chief of the police board, it was determined that the governor should be chief of the Tokio air-defence headquarters.

The deputy governor of the metropolitan district and the chief of the police board were to act as deputy chiefs of the air defence headquarters. In theory the air-defence headquarters under the governor was the central administrative organ for planning and conducting emergency operations during air raids.

In practice, however, this was not the case and the headquarters was in fact a rather large and cumbersome committee which occasionally met in a formal and strained atmosphere, to iron out differences between the two government agencies.

The metropolitan police board strongly and successfully resisted any effort to infringe on its authority in relation to air-raid defence operations.

Although the Governor of the Tokio Metropolitan District, as chief of the air-defence headquarters was legally empowered to make plans and issue directions to the chief of the police board, it is significant that, in fact, no directions were ever issued by the Governor to the chief of the police board on air-raid defence, and the Governor maintained the fiction of his position by never challenging the police board powers.

NOTE ADDED:

In the nuclear attacks on Hiroshima and Nagasaki, the earth-covered trench shelters were unoccupied, as were 70,000 tunnel shelter places at Nagasaki

YOSHIE OKA, OPERATOR OF HIROSHIMA'S AIR RAID SIRENS, HAS STATED RECENTLY THAT SHE WAS STOPPED BY ARMY COMMANDERS HAVING BREAKFAST!

LONDON: HIS MAJESTY'S STATIONERY OFFICE

1948

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Field Service Pocket Book

Pamphlet No. 4

1939

FIELD ENGINEERING

MILITARY TRENCH SHELTERS AGAINST EXPLOSIVES (WWI DATA).

2. *Details and calculations of men, time and tools required for the execution of certain field works.*
This detail is divided into :—

Part I : Details of tasks by individuals or by " units " required for work.
Part II : Simple figures showing work to be expected from a platoon of infantry.

Part I.

Note.—Tasks given in this table are those which can be expected from average trained infantry working parties under the following conditions :—

i. All tracing and marking out done beforehand, and materials dumped at site.
ii. Work carried out by day, or on a moonlight night.
iii. It is not raining.
iv. March to work does not exceed $1\frac{1}{2}$ hours.

In conditions less favourable tasks columns 5 and 6 must be correspondingly reduced. Additional time must be allowed for concealing work or the task must be reduced accordingly.

Item No. (1)	Nature of work (2)	No. of workers (3)	Time (4)	Quantity (5)	Task per man per hour (6)	Tools for party (7)	Remarks (8)
	Earthwork :— Excavation of trenches—						
1	i. In soft, sandy ground.	1	1 hr.	30 cu. ft.	30 cu. ft.	1 pick and 1 shovel.	i. The tasks given in col. 5 allow for the earth being thrown out of a trench, 4 ft. deep, to a distance of 8 ft., or, for throwing earth upwards to a height of 6 ft. When earth has to be thrown further than this, one shoveller should be added for every two diggers.
		1	4 hrs.	90 cu. ft.	—	1 pick and 1 shovel.	

Item No. (1)	Nature of work (2)	No. of workers (3)	Time (4)	Quantity (5)	Task per man per hour (6)	Tools for party (7)	Remarks (8)
	ii. In medium ground, *i.e.*, ground of average consistency for digging, or soft ground with stones or small roots.	1 1	1 hr. 4 hrs.	20 cu. ft. 60 cu. ft.	20 cu. ft. —	1 pick and 1 shovel. 1 pick and 1 shovel.	ii. When the depth of the trench is more than 4 ft. one shoveller should be added for every two diggers, to clear berms and make up parapet and parados to correct shape.
	iii. In hard ground or medium soil with stones and roots.	1 1	1 hr. 4 hrs.	15 cu. ft. 40 cu. ft.	15 cu. ft. —	1 pick and 1 shovel. 1 pick and 1 shovel.	iii. Sticks to clean shovels in wet clay. Crowbars for rocky ground. Hand axes or bill-hooks for cutting roots. Spare pick handles, etc., must be provided when required by the nature of the ground.
2	Shovelling earth already excavated	1 1	1 hr. 4 hrs.	40 cu. ft. 120 cu. ft.	40 cu. ft. —	1 shovel. —	Allows for 10-ft. horizontal throw.
3	Excavating earth and loading into wheelbarrows, stretchers, or baskets.	1	—	As under Serial No. 1.			Spare wheelbarrows, etc., must be available, so that the digger can fill one while the carrier is emptying the other.

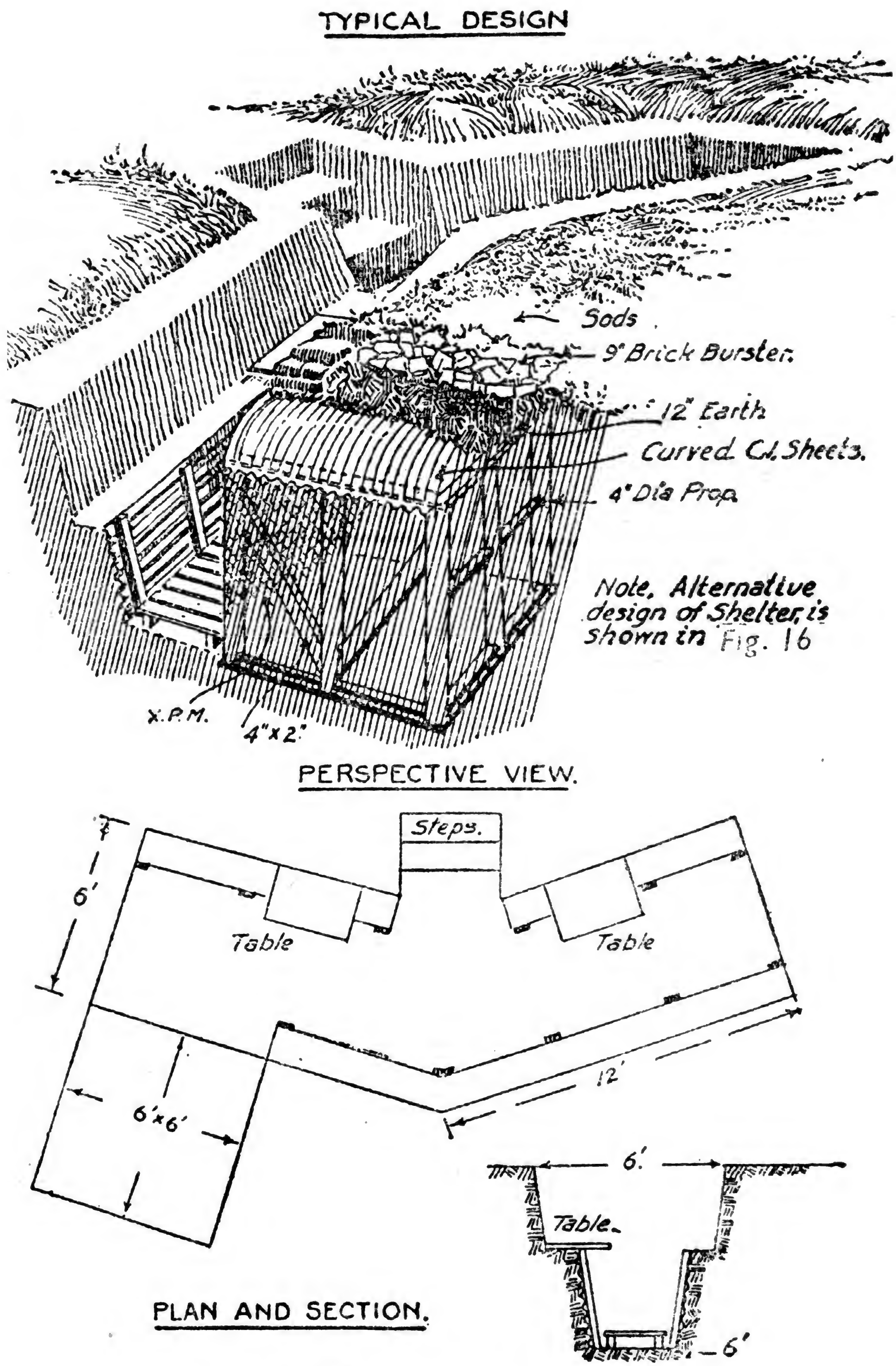
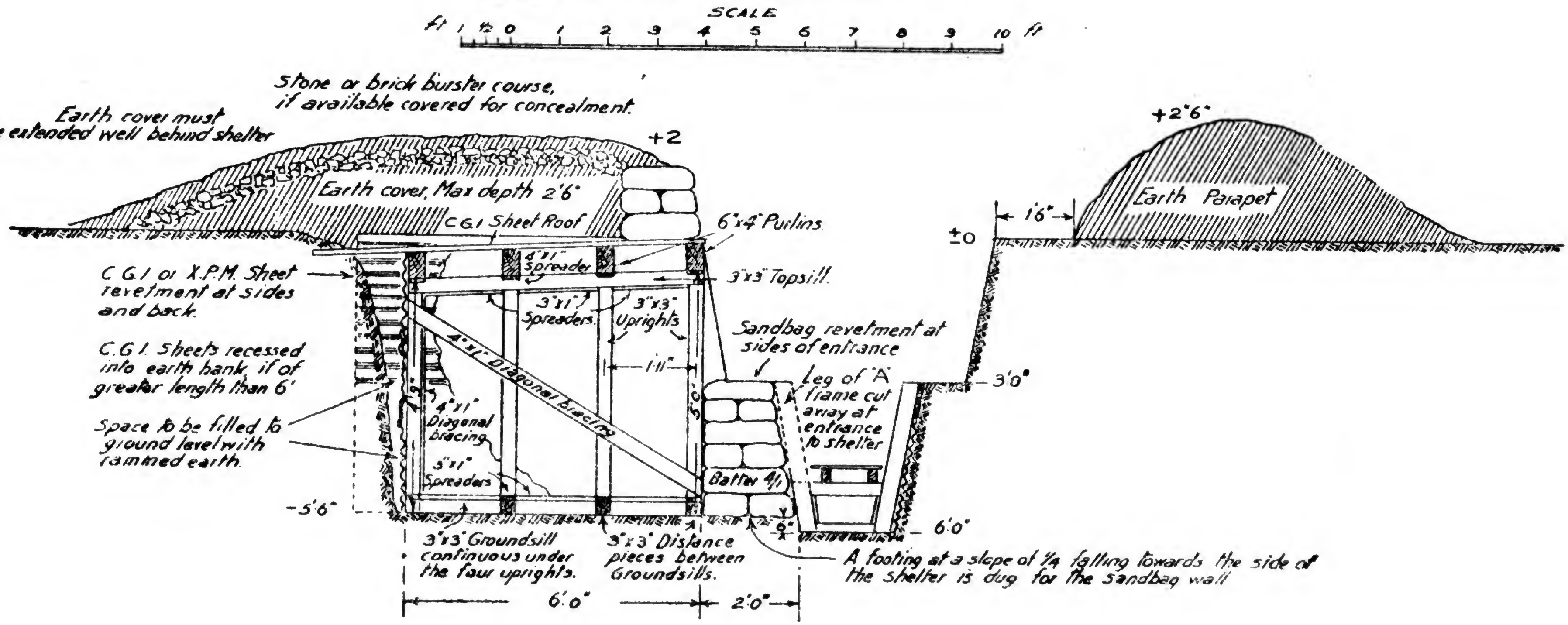


FIG. 14.—*Battery command post*

EXAMPLE OF A SPLINTER-PROOF TRENCH SHELTER

(IN A COMMUNICATION TRENCH.)



NOTE:- Purlins are designed for a 6' width of shelter. Two 3"x3" uprights are fixed between the purlin and bottom 3"x3" Distance piece at the back of the shelter at 1'11" centres, to support the back revetment

FIG 16.

To fill a crater 40 ft. diameter and 20 ft. deep requires about 400 man-tasks, organized in reliefs (say 4 reliefs of 4 hours). First reliefs have smaller number of men. Fifty barrows are required. The time is exclusive of formation of roadway.

6. *In sandy country.*—A quickly made and efficient track can be made by spreading out rolls of wire netting ($\frac{3}{4}$-in. or 1-in. mesh) on the ground and pegging it down firmly on both sides.

7. *Tracks for pack animals* consist of an earth formation on the best ground available; the route which involves the least earthwork should be chosen. Points to remember in constructing these tracks include :—

- i. The track should be 4 to 5 ft. wide for single traffic and 8 to 10 ft. for double. If less than 4 ft. the mules will slip off.
- ii. Surface drainage must be provided by means of a ditch on each side of the track.
- iii. "Up" and "Down" single tracks are better than one two-way traffic track.
- iv. For crossing boggy patches of ground, fascines, brushwood hurdles, or a corduroy of logs are useful.

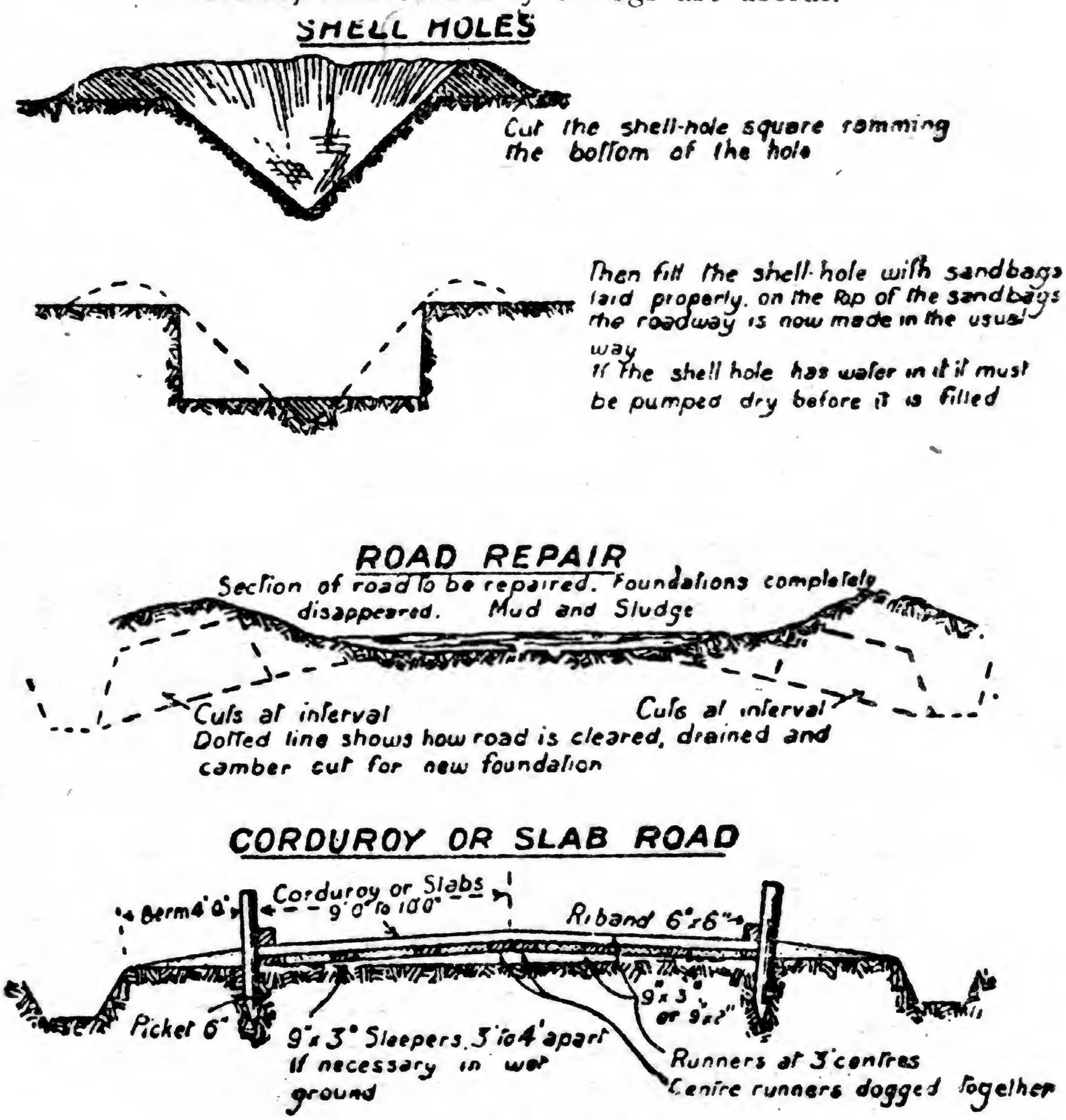


FIG. 30—*Forward roads*

CIVIL DEFENCE

Manual of Basic Training

VOLUME I

RECONNAISSANCE AND REPORTING

PAMPHLET No. 9

LONDON: HER MAJESTY'S STATIONERY OFFICE
1952

PAGE 32:

At present strategic attacks on cities with chemical warfare agents are thought of in terms of two agents—nerve gas and mustard gas. Nerve gas can only be effective when used on an unprotected population, therefore, good training and discipline in the use of the respirator combined with intelligent use of shelters would considerably reduce the number of potential casualties. In the case of mustard gas, however, the problem is different. Although the respirator will protect the eyes, nose, breathing passages and lungs, exposure of the skin to vapour will cause injury and the effects will be more serious if the exposure is prolonged or the concentration of vapour is high. (*See* Civil Defence Training Pamphlet No. 1 " Basic Chemical Warfare.")

If a gas attack was experienced it is probable that it would be accompanied by a proportion of high explosive bombs with the object of blowing in doors and windows of houses, etc., in order to expose the occupants immediately to the initial concentration of gas. The use of high explosive bombs would also cause roads to be obstructed with debris and broken glass and generally cause confusion, and delay the evacuation of the area.

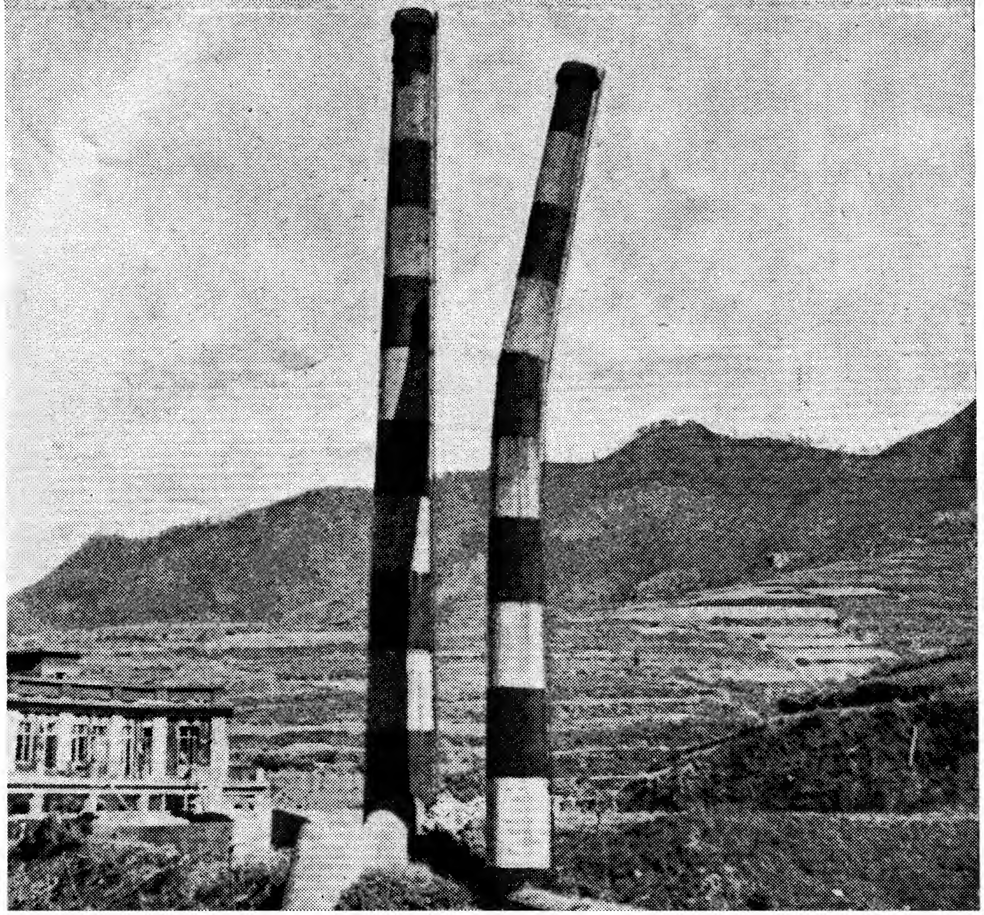


Fig. 10

Concrete chimneys, about $\frac{1}{2}$ mile from ground zero at Nagasaki, of which one has been bent away from the explosion.

Fig. 13

Blast effect on a number of telegraph poles about $\frac{3}{4}$ mile from ground zero at Nagasaki.

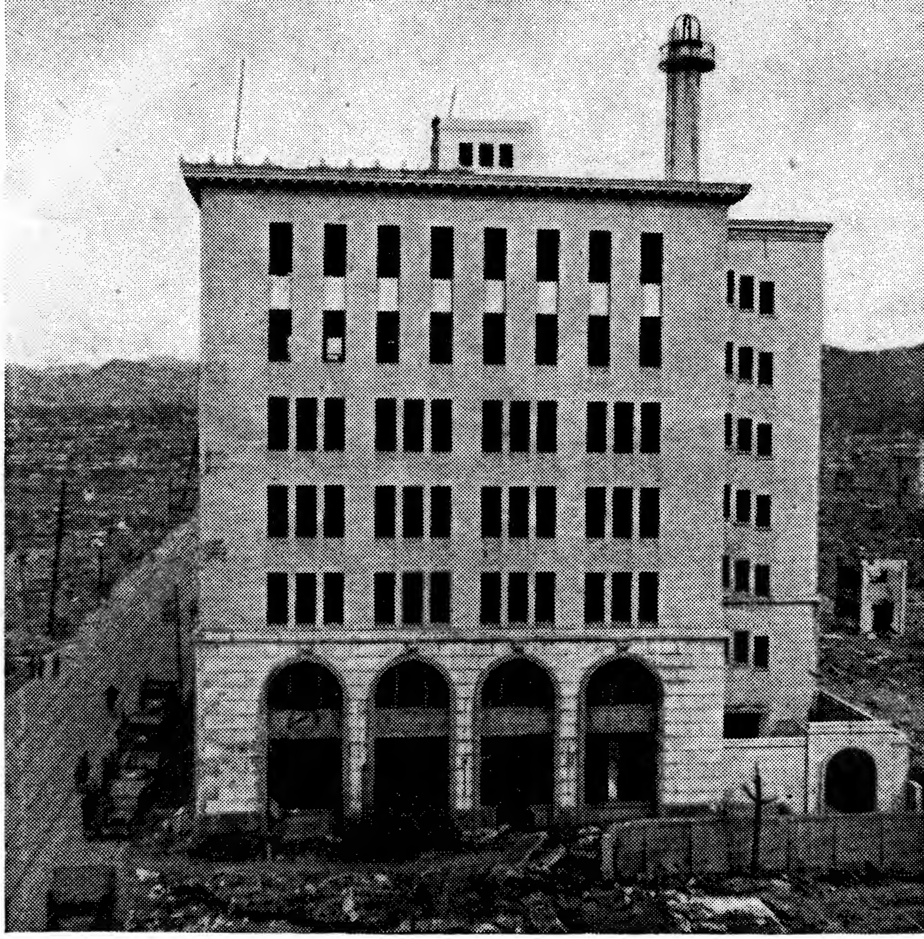


FIG. 14

Leaning flag-pole and lightning conductor on a building about $\frac{1}{4}$ mile from ground zero at Hiroshima. Note also lean of telegraph poles on left.

FIG. 16

Distortion of upper storey of a framed building just over $\frac{1}{4}$ mile from ground zero at Nagasak

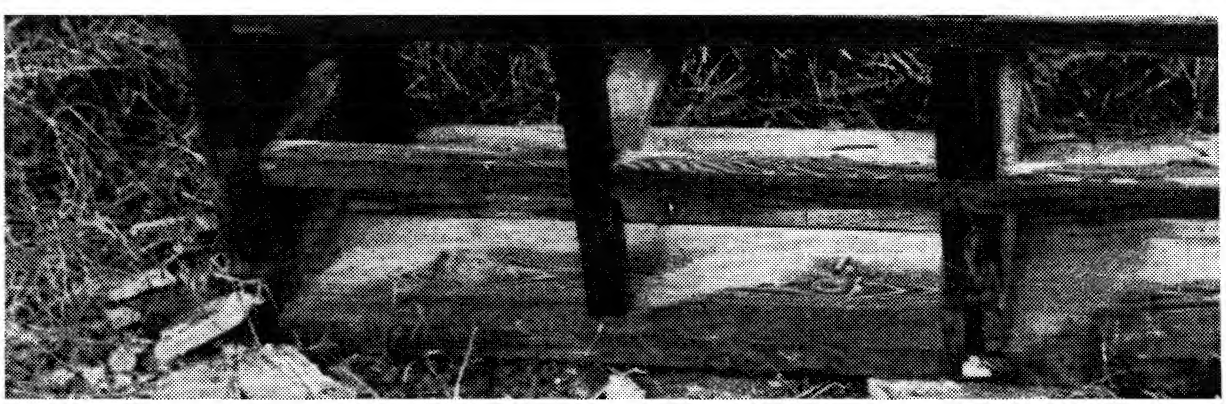


FIG. 18

Clear shadows on the woodwork of an up-turned bench, found some $\frac{3}{4}$ mile from ground zero at Nagasaki, show the direction of explosion. Note also shadows cast by posts

HOME OFFICE
SCOTTISH HOME DEPARTMENT

Civil Defence Industrial Bulletin No. 3

INDUSTRIAL FIRE PRECAUTIONS IN WAR

LONDON
HER MAJESTY'S STATIONERY OFFICE
1959
ONE SHILLING NET

Table of Contents

Prevention of Fires Caused by Nuclear Explosions

1. As stated in paragraph 11 of the Bulletin, adequate precautions against fires arising from normal sources would materially assist in reducing the risks arising from fires occurring from enemy action. This appendix gives details of additional precautions that would need to be taken against the special risks arising from nuclear explosions.

General Considerations

2. Both the extent to which fires might be caused and the efficacy of fire prevention measures would depend largely on the distance of the premises from ground zero. As, however, it is impossible to know where that would be, as many as possible of the recommended precautions should be taken in all industrial premises.

3. The heat rays against which buildings would need to be protected are those which would arrive at an angle of between 10° and 20° to the horizontal. This is because, if the heat flash from the explosion descended at any steeper angle than 20°, it would mean that the point of burst was near enough to the building for the latter to be destroyed by blast, while if the angle were shallower than 10° the building would not be in serious danger from heat flash. Consequently, fires would be most likely to be started on the roofs and top storeys of buildings since the lower floors of most buildings would be protected from heat rays by other buildings. The extent to which buildings are screened must be taken into account in applying the measures suggested below; it would not, for example, be necessary to protect windows on the lower floors of buildings if they gave no view of the sky at an elevation of much less than 20°.

4. The heat radiation from the fireball, like that from the sun, is largely reflected from a white surface and almost wholly absorbed by a dark one. Combustible material that cannot be screened can therefore be protected by painting it white or coating it with whitewash. Similarly, painting or whitewashing the glass of windows and skylights considerably reduces the amount of heat that would otherwise enter a building through them. Whitewash would keep out about 80 per cent of the total heat received before the window was broken by blast. As explained in paragraph 8 of the Bulletin, blast travels more slowly than heat and windows would not be broken until most of the heat that would reach them had been received. The proportion that would arrive before the blast would depend on the distance from ground zero, but at a distance of four miles it would probably be not less than 80 per cent. Whitewashed or painted windows would therefore keep out at least 65 per cent of the heat likely to reach any buildings in the main fire zone.

5. These general considerations affect the fire precautions to be taken in all buildings. Details of their application to particular parts of buildings are given below.

Protection against Primary Fires

6. *Exteriors.* Combustible flat roofs should be covered with a liberal coating of sand or other incombustible material. Other combustible surfaces should be coated with whitewash or white paint.

7. No readily combustible material should be kept in the open. If this cannot be avoided the material should be protected by screens or covers made of incombustible material or other material that can be treated in the ways described in paragraph 6.

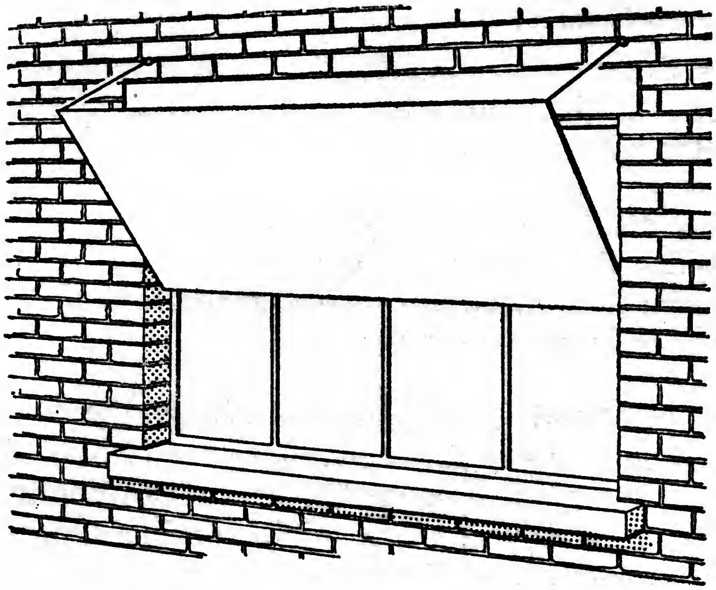
8. *Interiors.* As stated in paragraph 3 above, the top storey of any building would be the most vulnerable. If possible, it should be completely cleared, but if that cannot be done the amount of combustible material stored there should be reduced to the minimum. The chance of fire spreading inside the building will also be reduced by ensuring that as much space as possible is left between combustible materials.

9. Because of the shallow angle at which the heat radiation would arrive, vertical surfaces within buildings would be more vulnerable than horizontal surfaces. Combustible objects should therefore be removed from walls that face windows or other openings. If possible, interior wall linings should be of incombustible material.

10. Heat rays can enter buildings only through windows, skylights and other openings that admit light. Closed doors or shutters would give adequate protection against heat radiation, and provided the outsides were whitened they should not ignite and so start fires inside the building. Any openings, other than windows, not fitted with doors or shutters should be bricked up or covered with sandbags, if that was practicable and time permitted, or should be covered with screens made of incombustible material such as asbestos or metal. If such material could not be obtained, or was for some reason unsuitable, any opaque boarding or similar material could be used provided it was painted white on the outside.

11. Windows and skylights should, if possible, be similarly screened on the outside so as to give protection against blast as well as heat radiation. In most industrial premises, however, it would be impracticable to block up windows and skylights in such a way that all light was excluded and protective measures might therefore have to be limited to painting or whitewashing the windows, or as much of them as was necessary (see paragraph 3 above), preferably on the outsides.

12. An alternative method of protection which would allow more daylight to enter the building is shown in the diagram overleaf. It consists of a board painted white on both sides and fixed at an angle of about 45° to the outside of the window with the lower edge so arranged that the board covers all the view of the sky up to 20° from the horizontal and with the upper edge extending slightly above the top of the window. Light would then be able to enter the room from the sky but any heat radiation would be excluded.



A Simple Heat Radiation Shield

13. Louvres, set at an angle that excluded a view of the sky from any part of the room, or venetian blinds could also be used. The latter should, if possible, be made of metal; if they were made of combustible material they should be whitened.

Protection against Secondary Fires

14. As secondary fires are caused by blast, the precautions taken against that effect of nuclear explosions (which are outside the scope of this Bulletin) should themselves reduce the fire risk. Those precautions might not, however, prevent any damage from blast occurring and it would therefore be necessary to take further precautions against fire.

15. Every effort should be made to keep possible sources of ignition and combustible material, both in the structure of the building and in its contents, to a minimum.

16. Boiler rooms should be separated from the rest of the building by substantial and incombustible walls, ceilings and doors. Open fireplaces should be protected by fitting curbs to retain fuel on incombustible hearths and by securely fitting strong wire guards.

17. Oil fuel and other inflammable liquids should be stored below ground as far from buildings as possible. If this could not be done, the stores should have unbroken and substantial walls, ceilings and doors, and sills, raised thresholds or catchpits should be provided to prevent any oil that escaped within the store from flowing into other parts of the premises.

18. Gas and electric installations should be separated as far as possible. If a warning of enemy attack was received in time, all non-essential services should be turned off at the mains.

Assessment of Wartime Fire Hazards of Industrial Premises

1. The major considerations that govern the fire susceptibility of premises under nuclear attack are:

(*a*) the type of construction of the buildings (i.e. the degree of fire resistance inherent in their construction);

(*b*) the hazard of the occupancy and contents;

(*c*) the building density in the neighbourhood;

(*d*) the amount of unprotected openings in walls and roofs;

(*e*) the degree of screening that the buildings obtain from other buildings;

(*f*) the amount of combustible storage in the open; and

(*g*) the size of the premises.

These seven considerations can be used to create a formula to determine the fire risk of any premises and the amount and kind of fire protection equipment that the premises would require. Details of how this can be done are given below; if difficulty is experienced in assessing any of these factors the advice of the Chief Officer of the local authority fire brigade should be sought.

Grading of Premises

2. The premises are first graded under each of the seven headings given above (except (*g*)) and "points" are awarded according to those gradings. Where premises consist of a number of buildings of differing character, the premises as a whole can be placed into their correct grade by treating each building separately and finding the average of points gained.

(*a*) Type of construction of buildings

Premises are divided into three "grades" of risk according to their fire resistance, based on British Standard Definitions of Fire Resistance of Buildings and Structures, No. 476/1953. These three grades are allotted "points", as follows:

Low Risk Grade (2 points): those buildings which are of fire resisting construction throughout.

Intermediate Risk Grade (4 points): those buildings which will generally answer the description "ordinary" or "brick and joisted" construction.

High Risk Grade (6 points): those buildings which constitute a definitely dangerous risk.

(*b*) Type of occupancy and contents

Premises are again divided into three grades of risk, this time according to occupancy, as follows:

Low Risk Grade (2 points): those premises which, in general, are of small occupancy hazard, and do not fall into either of the other two classes.

Intermediate Risk Grade (4 points): large wholesale and retail stores, depots and warehouses other than those falling within the High Risk Grade; hospitals, large institutions, and factories not falling in either of the other grades.

High Risk Grade (6 points): hazardous occupancies.

(*c*) **Building density**

Under this heading, the grading for any premises varies according to the number of other premises or buildings which are situated within 60 feet of it. There are again three grades, but where any premises has no buildings at all within 60 feet of it, no points are awarded, thus:

Ungraded (0 points): those premises which have no other buildings within 60 feet of them on any side.

Low Risk Grade (1 point): those premises which have buildings within 60 feet of them on one side.

Intermediate Risk Grade (2 points): those premises which have buildings within 60 feet of them on two sides.

High Risk Grade (3 points): those premises which have buildings within 60 feet of them on three or four sides.

(Note that in this instance, and in those which follow, the number of "points" to be awarded to each grade is half the number applying under headings (*a*) and (*b*)).

(*d*) **Unprotected openings in walls and roofs**

For this purpose, the total wall and roof area for the premises is determined. The total area of all unprotected openings (i.e. openings which would permit the passage of heat flash) is also determined, and is expressed as a percentage of total wall and roof area. Points are then awarded as follows:

Low Risk Grade (1 point): those premises in which the area of unprotected openings is less than 25 per cent of wall and roof area.

Intermediate Risk Grade (2 points): those premises in which this percentage is between 25 per cent and 50 per cent.

High Risk Grade (3 points): those premises with over 50 per cent of unprotected openings in walls and roofs.

(*e*) **Degree of screening**

This involves making an approximate estimate of the extent to which the face of a building would be screened by other buildings from the effects of the heat flash from a nuclear explosion. In theory, this means looking at the building from all sides with an angle of sight of between 10° and 20° to the horizontal since, as explained in paragraph 3 of Appendix A, if the heat flash descended

at a steeper angle the building would probably be destroyed by blast, while if the angle were shallower the building would not be in serious danger from heat flash. For practical purposes an angle of sight of 12° has been chosen as giving a useful margin of safety, and this is represented by a sight of the building from a height of 50 feet from a distance of 200 feet and, if it were desired, an estimate could be made from this viewpoint of the area of walls visible; this total area would then be expressed as a percentage of the total area of the walls. However, in practice, it is usually a simple matter, even by standing near the building or buildings at ground level, to decide whether it is "considerably screened", "screened to a certain extent", or "not appreciably screened at all"—in other words, which of the following gradings would apply.

Low Risk Grade (1 point): those premises with less than 25 per cent of wall area left unscreened.

Intermediate Risk Grade (2 points): those premises with up to 50 per cent of wall area left unscreened.

High Risk Grade (3 points): those premises with over 50 per cent of wall area left unscreened.

(*f*) Combustible storage in the open

For this, the total area in plan on which combustible materials are stored in the open is expressed as a percentage of the total area in plan of the site. (If there is no open combustible storage, no points are awarded).

Ungraded (0 points): those premises with no open combustible storage.

Low Risk Grade (1 point): premises with less than 10 per cent of their site covered by open combustible storage.

Intermediate Risk Grade (2 points): premises with up to 25 per cent combustible storage.

High Risk Grade (3 points): premises with over 25 per cent of combustible storage.

Calculation of "Net" Points

3. At this stage, it is necessary in the application of the formula to determine the "net" points for the premises. This is done by totalling all the points gained under each of the six headings given in paragraph 2 and thus producing a single numerical assessment lying between 6 and 24 inclusive. An example of the working of this simple calculation might be as follows:

A building of fire-resisting construction	Low Risk Grade ..	2 points
is used for a hazardous occupancy	High Risk Grade ..	6 points
and has buildings within 60 feet on two sides	Intermediate ..	2 points

It has less than 25 per cent of unprotected openings	Low Risk Grade ..	1 point
over 50 per cent of wall area unscreened	High Risk Grade ..	3 points
but no combustible storage in the open	Ungraded	0 points
The "net" points allotted are therefore	..	14

Size of Premises and Calculation of "Gross" Points

4. It is next necessary to determine the "gross" points awarded. The size of the premises is first arrived at by adding together the superficial area in square feet of all floors of all buildings and the total area of combustible storage in the open. The premises are then placed in one of eight categories of size, as follows:

Category 1: premises with less than 2,500 square feet.
Category 2: premises with 2,500 to 7,500 square feet.
Category 3: premises with 7,500 to 25,000 square feet.
Category 4: premises with 25,000 to 75,000 square feet.
Category 5: premises with 75,000 to 250,000 square feet.
Category 6: premises with 250,000 to 750,000 square feet.
Category 7: premises with 750,000 to 2,500,000 square feet.
Category 8: premises with 2,500,000 to 7,500,000 square feet.

(*Note:* Premises larger than 7,500,000 square feet in total extent would not be suitable for the application of this formula as it stands.)

5. Each of these categories has a multiplication factor attached to it by which the "net" points must be multiplied to arrive at the "gross" points for the premises, as follows:

Category 1:
Multiply net points by $\frac{1}{8}$, and round up to the next whole number.
Category 2:
Multiply net points by $\frac{1}{4}$, and round up to the next whole number.
Category 3:
Multiply net points by $\frac{1}{2}$, and round up to the next whole number.
Category 4:
Multiply net points by 1.
Category 5:
Multiply net points by 2.
Category 6:
Multiply net points by 4.
Category 7:
Multiply net points by 8.
Category 8:
Multiply net points by 16.

This multiplication completes the assessment by producing a figure of gross points. Upon this figure the normal minimum standards of provision of fire-fighting equipment, dealt with in Appendix C, are directly based.

6. To extend the example quoted in paragraph 3, the factory concerned, which earned 14 "net" points, might be in Category 5 for size, i.e. have a total area of between 75,000 and 250,000 square feet on all floors including combustible storage in the open. The required multiplication factor is 2, which produces a "gross" points assessment of 28.

7. While this formula will work satisfactorily as a basis for the general run of industrial premises, there will be many instances where the general rule is not appropriate because special circumstances exist. Among other things, it may be necessary to consider:

(*a*) the possibility of combining premises together for purposes of assessment, where that seems desirable;

(*b*) making allowance for specially hazardous occupancies or storages; or

(*c*) making allowance for buildings of unusual height or for sites exceptionally spread out.

In all such cases, or in any case where the management desire it, the Chief Officer of the local authority fire brigade will be prepared to advise.

Provision of Fire-fighting Equipment

1. The fire-fighting equipment needed to meet the wartime fire hazards of industrial premises can be determined by reference to the "gross points" awarded under the method of assessing the fire hazards described in Appendix B.

Fire Points

2. The basic unit of hand fire-fighting equipment under this scheme is the "Fire Point". This comprises:

1 hand pump;
2 metal water buckets, filled;
2 additional "water points", each consisting of 2 filled buckets;
1 axe;
1 crowbar;
Chemical extinguishers according to risk.

3. For every "gross" point of the assessment of any premises ONE Fire Point should be the normal minimum standard. This would automatically mean the provision of TWO "water points" in addition, as shown above. Thus, in the example given in paragraph 3 of Appendix B, the factory which was allotted 28 gross points would be required to provide 28 Fire Points, with 56 Water Points in addition. (This would not be the only requirement however—see paragraph 5 below.)

Powered Pumps

4. Types of fire-fighting equipment other than hand pumps are grouped into "Units", which include the pump, the necessary ancillary equipment and a supplementary water supply sufficient for approximately one hour, as follows:

(*a*) *The "Minor" Fire Unit*

1 ultra-light pump of not less than 80 g.p.m. capacity at 100 lbs./square inch;
Hose, branches, breechings, etc.;
Supplementary water supply of not less than 5,000 gallons in two tanks of 2,500 gallons each.

(*b*) *The "Medium" Fire Unit*

1 light portable pump of not less than 300 g.p.m. capacity at 100 lbs./square inch;
Hose, branches, breechings, etc.;
Supplementary water supply of not less than 20,000 gallons.

(*c*) *The "Major" Fire Unit*

1 self-propelled pump of not less than 900 g.p.m. capacity at 100 lbs./square inch;
Hose, branches, breechings, etc.;
Supplementary water supply of not less than 60,000 gallons.

5. These units of equipment would be required, in addition to the Fire Points referred to in paragraph 2, on the following scale:

For every 12 gross points, ONE "Minor" Fire Unit; *and*

For every 30 gross points, ONE "Medium" Fire Unit; *and*

For every 200 gross points, ONE "Major" Fire Unit.

Managements should not, however, contemplate the provision of a self-propelled appliance ("Major" Unit) without consulting the Chief Officer of the local authority fire brigade.

6. On this basis, the factory referred to in paragraph 3 would require TWO "Minor" Units in addition to 28 Fire Points and 56 Water Points.

7. The standard crews for the pumps included in the three units are as follows:

"Minor" Unit	3
"Medium" Unit	5
"Major" Unit..	6

Group Assessments for "Medium" and "Major" Fire Units

8. In areas where Industrial Groups should be formed in pursuance of the advice given in Part III of Civil Defence Industrial Bulletin No. 2, e.g., where industrial premises are on factory estates, or where several factories are adjacent, it might be advantageous if the managements concerned consulted together as regards the provision of "Medium" and "Major" Fire Units on a group basis. Thus, a number of factories, none of which might by itself justify the provision of such units, might benefit if one or more of them were provided on a group basis after consultation between managements and the Chief Officer of the local authority fire brigade.

APPENDIX D

Syllabus of Standard Training for Members of the Fire Guard Section

Serial	*Subject*	*Hours*	*References*
	Part I: General Civil Defence Training		
1.	**Introduction**		
	Purpose of civil defence. Civil Defence Corps. National Hospital Service Reserve. Police and Fire Service. Industrial Civil Defence Service. Public utilities and nationalised industries. Armed forces. Regional organisation (England and Wales). Central and Zone organisation (Scotland).	1	Pamphlet — Organisation of Civil Defence and Allied Services; Warden Section Instructors' Notes.
2.	**The Threat**		
	(*a*) Nuclear Weapons:	2	
	(i) Introduction — nominal and hydrogen bombs. Features of nuclear explosions — general characteristics; types of burst. The immediate danger — heat radiation; immediate nuclear radiation; blast.		Warden Section Instructors' Notes.
	(ii) Residual nuclear radiation risks — fall-out; induced radioactivity. Residual decay. Radiation sickness. Radioactive poisoning.		Warden Section Instructors' Notes.
	(*b*) Fire: Fire raising danger from nuclear weapons and incendiary agents.	½	Civil Defence Handbook No. 4, Elementary Fire-Fighting; Warden Section Instructors' Notes.
	(*c*) High explosive missiles and unexploded missiles.	1	Methods of protection against High Explosive Missiles Pamphlet; Warden Section Instructors' Notes.
	(*d*) Biological and chemical agents: Broad outline of nature, characteristics and effects.	½	Pamphlet — Biological Warfare; Chemical Warfare Pamphlet; Warden Section Instructors' Notes.

Serial	Subject	Hours	References
3.	**Operational control**	1	Warden Section Instructors' Notes.
4.	**Nuclear weapons—Personal protective measures**	2	
	(*a*) Immediate danger. Protection against heat effect; screening from gamma rays; protection against blast and splinters; taking cover in an emergency.		Warden Section Instructors' Notes.
	(*b*) Delayed danger. Principles of protection; food and water.		Warden Section Instructors' Notes.
	(*c*) Demonstration of radiac instruments and lessons on the individual dosimeter (including practice in its use by the class).		Warden Section Instructors' Notes.
5.	**Respirators**		
	Function of essential parts; inspection and care; periodical cleansing. How to adjust and remove.	1	Chemical Warfare Pamphlet; Warden Section Instructors' Notes.
	TOTAL	9	

Part II: Fire Training

Serial	Subject	Hours	References
1.	**Organisation** General description and scope of fire defence arrangements in the premises and locality. Methods of giving alarm and assembling fire parties. Fire party organisation: designation and duties of members of teams. Outline of N.F.S. organisation. Communications within the premises; procedure for sending fire calls and requesting assistance.	2	Based on the Manual of Firemanship, the Fire Service Drill Book, Drills for Mobile Column Appliances and Civil Defence Handbook No. 4—Elementary Fire-Fighting.
2.	**Theory of fire and fire spread** Physics and chemistry of combustion: principles of fire extinction. Means whereby fire spreads — convection, conduction, radiation. Types of fire: special and unusual risks.	2	
3.	**Fire precautions** Precautions to minimise damage from heat flash, and other steps to reduce risk of secondary fires due to	2	

Serial	Subject	Hours	References
	blast. Clearance of top floors, lofts and roof spaces; protection of windows. Routine instructions in respect of main water, gas and electricity services.		
4.	**Fire Fighting** Assessment of a fire situation: reconnaissance and search for indications of fire. Methods of extinction of ordinary and special fires. Effectiveness, range and methods of use of appliances, including buckets of water, sand, hand pumps, extinguishers, branches on hose lines and other equipment as appropriate. Methods of working in smoke, and safety measures for fire-fighting personnel. Means of escape, methods of rescue and self-rescue.	4	
5.	**Water supplies** Water mains; static water supplies, including overhead tanks, emergency tanks, use of process water, improvising water storage, etc. Use and limitations of internal hydrants and hose reels.	2	Based on the Manual of Firemanship, the Fire Service Drill Book, Drills for Mobile Column Appliances and Civil Defence Handbook No. 4—Elementary Fire-Fighting.
6.	**Appliances and equipment** Constructional details of appliances. Pump operation. Maintenance of equipment and appliances: standard tests: care and maintenance of hose.	4	
7.	**Drills** (as appropriate to the equipment provided) say: Discharging extinguishers. Stirrup pump drills. Hose running drills. Pump drills, powered. Ladder drills. Knots and lines. Smoke drills and fire hut practice. Exercises including, where appropriate, exercises with fire parties of neighbouring premises.	6	
	TOTAL	22*	

*This total will vary with the time spent on drills (Part II, Serial 7).

Serial	Subject	Hours	References
	Part III: First Aid Training		
	First Aid	10	Civil Defence Training Memorandum No. 1 (1957), Appendix I (In Scotland, Memorandum enclosed with Civil Defence (Scotland) Industrial Circular No. 23); Civil Defence Handbook No. 6, First Aid; Civil Defence Pocket Book No. 1, The Elements of First Aid.
	Part IV: Light Rescue Training		
1.	Appreciation of damage to buildings; types of construction, unframed and framed — forms of collapse, voids, etc.; recognition of dangerous structures.	1	Civil Defence Handbook No. 5, Light Rescue; Rescue Section Instructors' Notes.
2.	Use of essential equipment including stretchers and how to improvise; improvised ropes and their uses in rescue—improvised stretchers and their handling. (*Note:* Two hours are allowed for practical work.)	3½	Civil Defence Handbook No. 5, Light Rescue; Rescue Section Instructors' Notes.
3.	Methods of rescue; emergency methods of moving casualties. Lightly trapped casualties. Care in moving debris. (*Note:* One hour is allowed for practical work.)	2½	Civil Defence Handbook No. 5, Light Rescue; Rescue Section Instructors' Notes.
4.	Rescue reconnaissance (and stages of rescue); treatment of surface casualties; searching for trapped casualties—calling and listening periods—immediate dangers from fire, water, gas, electricity, etc. (*Note:* Two hours are allowed for practical work.)	3	Civil Defence Handbook No. 5, Light Rescue; Rescue Section Instructors' Notes.
	TOTAL	10	
	GRAND TOTAL	51*	

*This total will vary with the time spent on drills (Part II, Serial 7).

HOME OFFICE

CIVIL DEFENCE DEPARTMENT

(1960)

Rescue Section Training Bulletin No. 2

NOTE.—This bulletin is in two parts. Part I sets out the syllabuses for the training of Rescue Section volunteers and Part II contains the syllabuses for the local training of Rescue Section instructors. The instructors' notes referred to in these syllabuses are the general (G) notes, published separately, and the *second edition of the Rescue Section instructors' notes.

I. Syllabuses for the Training of Rescue Section Volunteers

A: STANDARD TRAINING

Serial	Subject	Hours	Reference to Instructors' Notes
1	**Introduction to civil defence**	1	G1
2	**The threat**		
	(*a*) nuclear weapons:		
	(i) immediate danger	1	G2 and G4
	(ii) delayed danger	1	G3
	(*b*) other forms of attack	1	G7A
3	†**First aid**	10	
4	**Standard rescue** (detailed syllabus attached)	24	R1–R17
5	**Control of public in radioactive zones**	1	R70
6	**Nuclear weapons—protective measures**	2	
	(*a*) personal protective measures—immediate danger		G8
	(*b*) personal protective measures—delayed danger		G9
	(*c*) practical lesson in use of individual dosimeter and charging unit		G10
7	**Fire fighting**		
	(*a*) practical fire prevention measures	1	G11
	(*b*) practical fire fighting	1	G12

Serial	Subject	Hours	Reference to Instructors' Notes
8	**Protective measures against** (*a*) biological and chemical warfare (*b*) toxic industrial and other dangerous gases	 1½ ½	 G17A paras. 1–22 R71
	TOTAL	45	

* The second edition of the Rescue Section instructors' notes is now being printed and will be published shortly. Meanwhile the functional sessions of these syllabuses can be taught by reference to the appropriate chapters of Civil Defence Handbook No. 7, Rescue.

† The first aid syllabus should be introduced prior to sessions 4 and 5 of the standard rescue syllabus (syllabus B).

B: STANDARD RESCUE TRAINING

Session	Subject	Hours	Reference to Instructors' Notes
1	(*a*) Organisation, functions and training of the Rescue Section (*b*) Personal and party manpack	2	R1 R2
2	The Rescue Section and operational Control	2	R3
3	Fibre ropes and improvisations; Strength of fibre ropes; use of ropes; care and maintenance; improvised ropes; knots; lashings	2	R4
4	Casualty handling in rescue operations—normal methods. Webbing bands; blanketing a stretcher; stretcher lashing; stretcher drill; ambulance loading; labelling casualties; recovery of the dead and valuables	2	R5–R6
5	Casualty handling in rescue operations—improvised and emergency methods. Choice of method; methods suitable for one rescuer; methods suitable for more than one rescuer	2	R7
6	Appreciation of damage to buildings (*a*) the elements of building construction; (*b*) types of damage from modern air attack; (*c*) damage to public services; water; coal gas; electricity; refrigeration plants; special industrial hazards	2	R8–R10

Session	Subject	Hours	Reference to Instructors' Notes
7	The Rescue Plan and Stages of Rescue; rescue reconnaissance; five stages of rescue; marking buildings after search	2	R11
8	Use of small tools and work in confined spaces; type of work and tools suitable; care and maintenance of tools; debris clearance	2	R12–R13
9	Improvisations in rescue; some uses of the wire bond; laminating timber to form spar, etc.; propping, strutting and improvised supports	2	R14
10	Use of short ladders in rescue work—handling casualties over debris; obstacles; bridging gaps, etc.	2	R15
11	Rescue operations over debris and wearing party manpack equipment	2	R16
12	Practical day rescue exercise involving methods already taught*	2	R17
	TOTAL	24	

* A night rescue exercise will be included in refresher training.

C: SUPPLEMENTARY STANDARD TRAINING FOR DRIVERS

Serial	Subject	Hours	Reference to Instructors' Notes
1	Introduction to the vehicle; driving hints and practice	1	R18
2	Lubrication, care and maintenance (*a*) daily (*b*) weekly (*c*) monthly	1	R19
3	Duties and responsibilities of drivers; parking of vehicles; convoy driving	1	R20
	TOTAL	3	

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D: ADDITIONAL TRAINING

Part I

New information and revision	3 hours
First aid (revision)	3 hours

Part II

Team exercises e.g. an exercise in conjunction with the Ambulance and Casualty Collecting Section (in Scotland, Casualty Wardens), Headquarters Section and Warden Section, involving team work on the rescue training ground	10 hours (minimum)

Part III

Inter-section exercises. These should be designed to allow the section to exercise jointly with other sections within a fairly broad operational plan	6 hours
TOTAL	22 hours (minimum)

E: ADVANCED RESCUE TRAINING

Serial	Subject	Hours	Reference to Instructors' Notes
1	(*a*) Platoon rescue equipment; stowage of items; company equipment (*b*) Improvised pickets and holdfasts	2	R26–R27
2	Improvised derricks, shear legs and jib arms; methods of construction and application	2	R28
3	Hauling and lifting equipment; operating instructions; operational uses; application of equipment; steel wire ropes, chains and slings	4	R29–R30
4	Hydraulic rescue kit; operating and maintenance; application in rescue	4	R31
5	Rescue from heights; suspension methods by ropes; lowering by snatch block and 2 in. rope; lowering by means of ladders	2	R32
6	Temporary shoring; raking shore; flying shore; dead shore; elementary demolition	2	R33
7	Access to and linking of voids; debris crawlways; dealing with obstacles, handling casualties in crawl-ways	2	R34

Serial	Subject	Hours	Reference to Instructors' Notes
8	The uses in rescue of (*a*) flame cutting equipment and (*b*) portable floodlighting	2	R35–R36
9	Practical rescue exercise	4	R37
	TOTAL	24	

F: FLAME CUTTING AND PORTABLE FLOODLIGHTING TRAINING

Serial	Subject	Hours	Reference to Instructors' Notes
	(*a*) For those members of the section who will normally be responsible for operating the flame cutting outfit		
1	Flame cutting; the portable cutting outfit and accessories; cutting gases; safety regulations; storage and use	2	R42–R43
2	Assembly of portable outfit and flame setting; simple cutting	2	R44–R45
3	Advanced cutting; precautions in rescue when using the flame cutter	2	R46–R47
	TOTAL	6	
	(*b*) For those members of the section who will be responsible for operating the portable floodlighting units		
1	Portable floodlighting units	2	R48

G: REFRESHER TRAINING

The refresher training should be of approximately 12 hours duration and in the main should consist of rescue exercises both by day and night. Three hours should be allocated for general revision and new information.

Combined exercises with other sections of the Civil Defence Corps and other services will be additional.

H: TRAINING FOR PARTY LEADERS

Serial	Subject	Hours	Reference to Instructors' Notes
1	General duties—local Rescue Section organisation and routine	1	R53
2	Briefing of services; verbal orders from Rescue officer to party leaders	2	R54
3	Duties of a party leader		
	(*a*) Leaders and their responsibilities; personal qualities and practical ability; duties of leader at scene of operations; co-operation with other services; handing over and reliefs; recovery of valuables; procedure in regard to the dead	1	R55
	(*b*) Leader's duties during rescue reconnaissance and the stages of rescue	1	R56
	Oral and practical test	2	See footnotes to R56.
	TOTAL	7	

II. Syllabuses for the Local Training of Rescue Section Instructors

A: QUALIFYING SYLLABUS

(This syllabus is planned so that it may be taken either in one sequence of 80 hours or alternatively in two stages where this is more convenient. Stage One is of 50 hours and covers standard training, whilst Stage Two is of 30 hours and covers advanced rescue training.)

Serial	Subject	Hours	Reference to Instructors' Notes
	Stage One		
1	**Introduction to civil defence**	1	G1
2	**The threat**		
	(*a*) nuclear weapons:		
	(i) immediate danger	1	G2 and G4
	(ii) delayed danger	1	G3
	(*b*) Other forms of attack	1	G4–G7 and G7A
3	**Standard Rescue**	24	
4	**Control of public in radioactive zones**	1	R70
5	**Nuclear weapons—protective measures**	2	
	(*a*) personal protective measures—immediate danger		G8
	(*b*) personal protective measures—delayed danger		G9
	(*c*) practical lesson in use of individual dosimeter and charging unit		G10
6	**Fire fighting**		
	(*a*) practical fire prevention measures	1	G11
	(*b*) practical fire fighting	1	G12
7	**Protective measures against**		
	(*a*) biological and chemical warfare	$1\frac{1}{2}$	G13–G15 and G17a, paras. 1–22
	(*b*) toxic industrial and other dangerous gases	$\frac{1}{2}$	R71
8	**Supplementary information for instructors only**		
	(*a*) Methods of instruction: lesson, lecture, demonstration, playlet, exercise, discussion, training aids—to include practice lecturette and lesson	7	R80–R81
	(*b*) Radiac instruments and sources for training	2	R82
	(*c*) Practical periods on training ground, viz. staging of practice fires; use of the rescue set; and light rescue demonstration	3	R83–R85

Serial	Subject	Hours	Reference to Instructors' Notes
	Stage One—continued		
9	**General revision**	3	
	TOTAL FOR STAGE ONE	50	
	Stage Two		
10	**Advanced Rescue**	24	
11	**Practice and revision on serial 10**	6	
	TOTAL FOR STAGES ONE AND TWO	80	

QUALIFYING EXAMINATION

1. The examination at the end of stage one (standard rescue) or stages one and two (standard and advanced rescue) will consist of the following four parts:

Part I. A lecturette designed to test the candidate's ability to instruct by the lecture method. The candidate is required to develop, but not necessarily to complete, a lecture on a functional subject of which he has been notified beforehand. Time allowed: 15 minutes.

Part II. A practical test of the candidate's ability to instruct by the lesson method, i.e. instruction by any combination of explanation demonstration and practice. The candidate is required to give a complete lesson on a functional subject of which he has been notified beforehand. Time allowed: not less than 15 minutes.

Part III. An oral test consisting of not fewer than five questions, mainly on functional subjects but covering also the use of certain items of equipment, e.g., radiac instruments. The questions will be designed to test the candidate's knowledge and his ability to express it briefly and clearly in oral answers.

Part IV. A written paper of five questions on general subjects and of a type which cannot be dealt with by short oral answers. This paper will be designed to test the candidate's knowledge and his ability to marshal the facts. Time allowed: 2 hours.

In each part of the examination, the pass mark will be 65 per cent.

2. In the examination at the end of stage one (standard rescue), the questions will be confined to serials 1–9 of the syllabus. A candidate who passes each of Parts I–IV of the examination will qualify for a full certificate (standard). A candidate who passes in Parts I–III of the examination, but fails in Part IV, will qualify for a functional certificate (standard).

3. In the examination at the end of stages one and two (standard and advanced rescue taken together) the questions will be set on any part of the syllabus. A candidate who passes each of Parts I–IV of the examination will qualify for a full certificate (standard and advanced). A candidate who passes in Parts I–III of the examination, but fails in Part IV, will qualify for a functional certificate (standard and advanced).

4. Rescue Section instructors who hold a certificate in standard rescue only and wish to qualify in advanced rescue must take an examination consisting of two parts in the same form as Part II (a practical test) and Part III (an oral test) of the examination described in paragraph 1. The questions will be confined to serial 10 of the syllabus. To pass, the candidate must obtain a mark of not less than 65 per cent. in each part. A successful candidate will receive a standard and advanced certificate (full or functional) in replacement of and valid for the same period as his original standard certificate.

5. A Rescue Section instructor with a functional certificate (i.e. one who passed the examination in Parts I–III only) may be allowed to sit Part IV (written paper) a second time, and if successful, his functional certificate will be replaced by a full certificate valid to the same date as the original certificate. Further attempts may be allowed only in exceptional circumstances at the discretion of the Regional Director of Civil Defence (in Wales, the Director of Civil Defence for Wales, and, in Scotland, the Scottish Home Department).

Serial	Subject	Hours	Reference to Instructors' Notes
1	**Introduction to civil defence**	½	G1
2	**The threat** (*a*) nuclear weapons (i) immediate danger (ii) delayed danger (*b*) other forms of attack	1½	G2–G7 and G7A
3	**The Rescue Section and operational control** Control and deployment of services—use of rescue parties	1	R3
4	**Control of public in radioactive zones**	1	R70
5	**Nuclear weapons—protective measures**	1	G8–G10
6	**Fire Fighting** (*a*) practical fire prevention measures (*b*) practical fire fighting	1	G11 G12
7	**Protective measures against** (*a*) biological and chemical warfare	1	G13–G15 and G17A, paras. 1–22
	(*b*) toxic industrial and other dangerous gases	½	R71
8	**Standard Rescue** (*a*) Organisation, functions and training of the Rescue Section (*b*) Personal and manpack equipment	1	R1–R2
	Knots and lashings	1	R4
	Casualty handling in rescue operations	2	R5–R7
	The Rescue Plan and Stages of Rescue	1	R11
	Use of small tools in confined spaces; debris clearance improvisations in rescue; uses of the wire bond; laminating timber to form spar, etc.	2	R12–R14
*9	**Advanced Rescue** (*a*) Platoon rescue equipment; stowage of items; company equipment (*b*) Improvised pickets and holdfasts	1	R26 R27
	Improvised derricks, shear legs and jib arms; methods of construction and application	1	R28

Serial	Subject	Hours	Reference to Instructors' Notes
*9	**Advanced Rescue**—*continued*		
	Hauling and lifting equipment; operating instructions; operational uses; application of equipment; steel wire ropes, chains and slings; rescue from heights	2	R29–R30 and R32
	Hydraulic rescue kit; operating and maintenance; application in rescue operations	2	R31
	Temporary shoring; raking shore; flying shore; dead shore; elementary demolition	1	R33
	Access to and linking of voids; debris crawlways; dealing with obstacles; handling casualties in crawlways	1	R34
10	**Supplementary information for instructors only** to include practice lessons and methods of instruction; use of appropriate radiac instruments and sources; use of rescue training set	8	R80, R82 and R84
11	**General revision**	1	
	TOTAL	31½	

* Instructors qualified in standard rescue only are not required to take this serial.

REQUALIFYING EXAMINATION

1. The requalifying examination for Rescue Section instructors will consist of the following two parts:

Part I. An oral test consisting of not fewer than five questions, three on functional subjects and two on general subjects. The holder of a Rescue Section instructor's functional certificate will not, however, be required to answer questions on general subjects. The questions will be designed to test the candidate's knowledge and his ability to express it briefly and clearly in oral answers.

Part II. A practical test of the candidate's ability to instruct by the lesson method, i.e. instruction by any combination of explanation, demonstration and practice. The candidate will be required to give a complete lesson on a functional subject notified to him beforehand. Time allowed: not less than 15 minutes.

2. The questions on general subjects will be based on serials 1–7 of the requalifying syllabus. The questions on functional subjects will be based on serials 8–10 except that a candidate seeking to requalify in standard rescue only will not be examined on serial 9.

3. A candidate who passes (i.e. obtains a mark of not less than 65 per cent.) in both the functional and the general parts of Part I, and in Part II of the examination, will be awarded a full certificate (standard) or a full certificate (standard and advanced) as the case may be. A candidate who passes in functional subjects but not in general subjects will be awarded a functional certificate (standard) or a functional certificate (standard and advanced) as the case may be. In each case, the certificate will be valid for five years, from the date of the examination.

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THE BRITISH RED CROSS SOCIETY

FOREWORD

BY

MR. DAVID RENTON, T.D., Q.C., M.P.

Minister of State for Home Affairs

The St. John Ambulance Association, the St. Andrews' Ambulance Association and the British Red Cross Society have for long given invaluable help to Civil Defence. It is evidence of the close co-operation that exists between them and the Government departments and local authorities responsible for Civil Defence that their joint first aid manual is now being adopted, together with this civil defence supplement, as the basis of first aid training for members of the Civil Defence Corps. In commending this supplement and the manual to all those giving and receiving first aid training in civil defence, I would like to take this opportunity of sending them my good wishes and my sincere thanks for their efforts and enthusiasm.

David Renton

CHAPTER 1

NUCLEAR WARFARE

1 There are four main kinds of injury resulting from the detonation of nuclear weapons and casualties may suffer from any combination of these effects. They are:

(i) temporary blindness caused by the intense light;

(ii) burns from light and heat radiation or from fires;

(iii) blast injuries;

(iv) radiation sickness.

Blindness

2 The intense white light which is the first evidence of a nuclear detonation may cause temporary blindness, lasting from seconds to half an hour if the explosion occurs in daylight; at night, blindness may last much longer.

Burns

3 A large number of burn wounds may be expected through light and heat radiations. The burns are likely to be of two kinds:

(i) the immediate wave of light and heat radiation will cause burns, varying from superficial to deep, to persons directly exposed to it. The appearance of the burn may be delayed for some time. The face, hands and neck are usually most affected.

(ii) fires, started by light and heat radiation setting fire to inflammable materials, or as a result of blast damage, e.g. buildings collapsing on to domestic fires, may cause burns.

Both types of burns are treated as ordinary heat burns (see Chapter 10 in the First Aid Manual).

Treatment

4 Within a wide area round a nuclear explosion everyone caught out of doors or near unprotected windows will suffer some degree of burning of the exposed skin. Generally the effects will be fairly superficial. For many no special treatment will be required,

and most will heal rapidly. Blisters are not common with this type of burn: if they do occur, they should not be broken, but if there is painful tension they may be pricked with a needle sterilised in a flame.

Severe burns should be protected by clean dressings. NO ATTEMPT should be made to clean the burnt area, and burnt material should be left on the wound. No oils or ointments should be put on burns—only dry dressings.

Large burns cause loss of body fluid. This should be made good with a special drink made up of one level teaspoonful of common salt, and half a teaspoonful of bicarbonate of soda in two pints of water flavoured or sweetened to taste.

This drink will also be found advantageous for casualties with crush injuries and for those suffering from radiation sickness.

Blast injuries

5 The wave of blast which results from a nuclear explosion may cause damage to the lungs or other internal organs, with consequential internal hæmorrhage, the ear drums may be burst, and there may be bleeding from the nose and ears. Other injuries such as fractures, crush injuries and lacerations may also be present. The normal first aid treatments for these conditions should be applied.

Radiation sickness

6 Radiation sickness is caused by gamma radiation penetrating the body and damaging the cells of its various tissues. In a nuclear explosion the body may be subject to the immediate neutron or gamma radiation released at the time of the explosion, or to gamma radiation from radioactive dust subsequently deposited as fall out; the amount of radiation received determines whether illness results and whether that illness is mild, serious or fatal. The symptoms of radiation sickness are nausea, with or without vomiting, and usually coming on several hours after exposure, followed by loss of appetite, severe diarrhœa, intense thirst and debility. Among the later symptoms of radiation sickness are bleeding into the skin (gums and bowel), delayed healing of wounds, loss of hair, which necessitate prolonged medical and nursing care.

Treatment

7 If the casualty has been contaminated by radioactive dust, thorough cleansing is important. If he has diarrhœa and vomiting,

especially with signs of shock, he should be put to rest and seen by a doctor. Rest and fluids by the mouth are the best first aid treatment. There are however two important points to remember:

(i) many persons who have experienced a nuclear explosion will have diarrhœa and vomiting of nervous origin—without shock—and should be dealt with accordingly.

(ii) There may be an occasional case of a person whose duty has taken him into a contaminated area developing symptoms of mild radiation sickness. The dose of radiation such persons are allowed to receive has been controlled. No anxiety should be felt; a period of rest with plenty to drink will be all that is necessary.

Treatment

6 If the presence of nerve gas is known or suspected respirators must be put on at once. Liquid on the skin must be quickly removed by dabbing it off with a wet cloth, cotton wool, cotton waste, or handkerchief; anti-gas ointment should be applied if available or alternatively the skin should be washed with soap and water. Liquid in the eye should be rapidly washed out. If any liquid has been swallowed, e.g. by taking contaminated food or water, vomiting should be induced; an alkaline drink (a table-spoonful of bicarbonate of soda in a cup of water) should then be given.

7 A drug which acts as a very good antidote to nerve gas is atropine. Adequate supplies of atropine exist and would be distributed if there were a possibility of this form of warfare being started. It has to be given by injection and because of the rapid action of nerve gas it has to be given immediately, preferably by the victim himself. If breathing is very slow or has ceased, the use of atropine must be supplemented by prolonged artificial respiration.

CHAPTER 3

CRUSHING INJURY—INJURIES FROM BLAST—ABDOMINAL INJURY

Crushing injuries

1 In war when high explosive or nuclear weapons are exploded a large proportion of casualties is caused by the collapse of buildings due to blast. Of these casualties, some are found to be pinned down by beams, brickwork or other heavy debris across their limbs and other portions of the body and may remain trapped for several hours, especially at night.

2 Some of these casualties, when extricated, show little external sign of injury and may complain of nothing more than numbness and stiffness of the muscles in the crushed part, even though this has been subjected to considerable pressure. Their general condition may appear quite good, both during the time they are trapped and after they are freed. Many recover completely after appropriate treatment and rest in hospital. In some cases, however, "shock" develops within a few hours. With adequate blood transfusion all but the most severe cases survive. In some of these casualties, after recovery from "shock" the kidneys become unable to excrete urine, and if this inability is not overcome the casualty will die because of the accumulation of waste products in the body. Such cases are said to have developed "crush syndrome" ("syndrome" being the term applied to a group of symptoms). It should be emphasised that this syndrome only occurs when the blood supply to the muscle has been cut off for some hours. This happens more frequently to the limb muscles, since they are less protected than those of the body. Certain substances derived from the crushed muscle may poison the kidneys. For this reason drinks should be given at the earliest opportunity to ensure that the harmful substances are washed out rapidly. This should be done for all persons who have been trapped by debris for one hour or more, as they may possibly develop crush syndrome, whatever their apparent condition when found. They must all be treated as serious casualties requiring urgent attention to avert a serious outcome.

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CHAPTER II

EVACUATION

12. Objects of the Plan

The aim of the evacuation plan is dispersal, *i.e.*, to thin out the population from the large congested target areas and distribute it in less vulnerable areas. The extent to which dispersal is practicable obviously depends, among other things, on the amount of accommodation available in the areas selected for reception and the degree to which industrial activity must be maintained in the evacuation areas. The indiscriminate transfer of the general population of large industrial towns would have a crippling effect on the economic life of the country and it is essential in the national interest that in war time all persons having work of national importance should remain at their posts unless the Government advises them to move. But it is only common sense to reduce the density of population in probable target areas. It has been decided, therefore, that in the event of war, facilities will be available for the voluntary transfer of certain defined groups from the congested target areas (called evacuation areas) to relatively safer areas (called reception areas). These facilities will be provided in two ways :—

(1) Through an organised scheme, which will be limited to certain groups to be known as the priority classes and consisting of school children, expectant mothers, and children under 5 accompanied by their mothers or other responsible adults. Participation in this scheme will be voluntary.

(2) By assisting certain classes who prefer to make their own private arrangements for evacuation. Such assistance will not be confined to the priority classes, but will also be available for the aged infirm, blind persons and cripples.

13. Classification of Areas

As in 1939, the country has been divided into evacuation, reception and neutral areas, the last being areas which, though not themselves to be evacuated, are not regarded as suitable receiving areas for organised groups, although those making private arrangements may go there if they wish to do so.

14. Plan for Organised Movement

(i) *Priority Classes*

The main movement will be by rail and will be planned with a view to obtaining as rapid dispersal as possible. Normally the general body of school children, who form the largest and most easily mobilised group, will be moved first in organised parties, accompanied by their teachers and other escorts. Mothers with children under 5 and expectant mothers (except those in the last month of pregnancy) will in general travel after the school children have gone, since mothers with older children would be unwilling to leave home before them and many others would be reluctant to leave until they had made the necessary domestic arrangements. The aim is to send expectant

mothers and mothers with young children to the more urban reception areas where the facilities and services they need will be more accessible. Women in the last month of pregnancy and parties of nursery children and handicapped children will not as a rule be included in the movement by rail ; special arrangements will be made for each of these groups to travel direct to destinations where preparations to meet their special needs will have been made.

(ii) *Facilities for Private Evacuation*

Government help will be offered to those members of the priority classes who wish to move privately to the reception or neutral areas and to certain other categories of persons. This help will take the form of free travelling vouchers and the payment of billeting allowances on the same basis as under the organised scheme provided proof is forthcoming that accommodation has been secured in a reception or neutral area.

(*a*) *Mothers and Children.* For mothers with children under 5 and expectant mothers who are able to find their own accommodation with relatives or friends, this will be an alternative to inclusion in the organised movement. With a view to keeping families together, the plan will include, if the parents so desire, their children of school age as well as their children under 5.

It is believed that many more families living in large towns now have friends in the country than they had in 1939 and this should facilitate the making of private arrangements. Such private arrangements will be given every encouragement, for not only do they avoid the separation of school children from their mothers but they enable families leaving home to know their destination in advance and to have the greater comfort of staying with friends or relatives instead of in a strange household.

(*b*) *Aged—Infirm, and the Blind and other Handicapped Persons.* Similar facilities are available for old infirm people, the blind, and cripples. No hard and fast definition has been laid down as to who should be included but the facilities are intended primarily for those persons who are not able to take care of themselves and whose presence in the evacuation areas would be an additional problem for the civil defence and other services.

(iii) *Special Parties*

There are among the priority classes certain groups of children for whom satisfactory provision cannot be made within the main stream of organised evacuation. These groups fall into three categories :—

(1) Residential nurseries and residential special schools, where residential accommodation is provided in time of peace by local authorities or voluntary organisations.

(2) Day nurseries, and nursery schools.

(3) Day schools for handicapped children.

(*a*) *Children of Nursery School Age* (see above categories (1) and (2).

Residential accommodation will be required for all children ordinarily cared for in residential nurseries (category (1)). Some children attending Day Nurseries and Nursery Schools

must be realistic and not paint too rosy a picture of what is to come, for example, people should not be led to believe that in the reception area they will be offered empty houses for their exclusive use. On the contrary every opportunity should be taken of explaining the need that will exist on both sides for goodwill and give and take in private billets which may well be filled to capacity.

On arrival at the detraining station the Party Leaders and escorts will receive directions from the reception authorities and in the meantime should keep the groups and their belongings together. If the escorts are to remain as helpers in the reception area overnight, accommodation will have been arranged for them but they should understand that their personal comfort must be a secondary consideration because the care of the evacuees must have first place with the officers of the reception authority.

16. Arrangements in Reception Areas

(i) *General Organisation*

In reception areas the local authorities will already have set up Reception Committees for the preliminary planning of their role in the Evacuation Scheme. They will also have appointed a Chief Billeting Officer. When the evacuation scheme is brought into operation, the Reception Committees will become Billeting Committees and, as such, will be responsible for the reception of evacuees, their transport to billets or other accommodation, and their welfare so long as they remain in the reception areas. Where the reception authority is a municipal borough or urban or rural district council, the Reception Committee will normally include a representative nominated by the county council. In this way, the necessary liaison will be secured between the billeting authority and the education, health, welfare, and children's services provided by the county council which will be expanded as far as possible to meet the increased demands made upon them.

(ii) *Information about Local Facilities and Services*

The Reception Committee will arrange for information about local services to be readily available to the evacuees. They may also consider it desirable to issue a leaflet to adult evacuees giving the address of Post Office, Food Office, places of worship, etc., together with information as to other official and voluntary services and where to apply for advice or assistance if in difficulty. Guidance of this kind is one of the ways in which newcomers to a district can be helped to feel welcome and to settle down.

Problems connected with billeting will be dealt with at the local Billeting Office but the Information Centres which local authorities will set up in most districts will provide information, and advice where appropriate, about local facilities, including government and local authority services. These Information Centres will be staffed mainly by members of the Welfare Section who have been specially trained for the work (See Chapter VI).

(iii) *Reception on Arrival*

Suitable halls will be prepared as near to the station as possible for use as reception centres from which evacuees can be dispersed to their billets. Where it is necessary to use one detraining station for evacuees destined for several billeting areas, the different local authorities

26. Needs of the Homeless

Experience in dealing with those who resort to rest centres has shown the importance of :—

(*a*) A friendly welcome and kindly attention to their immediate physical needs ;
(*b*) a hot drink, preferably tea with sugar, soon after admission ;
(*c*) tact and patience ; and
(*d*) promptness in arranging for their return to their homes, or if they are genuinely homeless, their transfer to other accommodation.

All staff should keep a look out for people who may need nursing, first-aid or medical attention so that they can be treated without delay.

The staff should learn how to recognise shock and should be patient and considerate in dealing with those suffering from it. One effect of shock is that the mind works more slowly than usual, and therefore all instructions and notices should be clear and simple. Another effect is that people find it difficult to make up their minds, and may have to be helped to make decisions, for example, about their future plans. Some people may be dazed, exhausted and inert ; others excited, noisy or tearful. Many may only want a kindly listener, though others may well continue to be dispirited for a time. Most people will recover fairly quickly if their immediate needs are met and they are reassured. Some respond to the sense of being in a group and appreciate community singing and so forth, especially if raids occur. The important thing for helpers is to be sensitive to the varying needs of individuals and imaginative about meeting them.

27. Recruiting Helpers among Homeless in Rest Centres

During World War II, it was found that able-bodied persons, once they had settled in, preferred to be up and about, doing something, rather than just sitting around. The atmosphere of friendly activity certainly did much to maintain the morale of rest centre occupants, while some additional help for the staff can be very timely. In any future war the greater intensity of the attacks will make this "self-help" even more valuable than it proved in 1939/45.

The supervisor and the shift leaders will have to exercise a certain amount of care in the selection of helpers. Some who offer eagerly are not yet sufficiently recovered ; others who hang back would, if asked, glady help. The aim should be to give people jobs for which they are most suited, *e.g.*, the housewives could help with the meals and care of the young children, the office workers with the clerical work and the stronger men with the moving of equipment and the heating arrangements. Helpers should work under the general direction of a member of the rest centre staff, but it is important that so far as possible volunteers who can take responsibility should be given it.

It is advisable to allocate the duties in such a way as to give jobs to as many volunteers as possible. The tasks suitable for rest centre occupants will vary according to the size of the centre and the number of staff on duty. The following will give some idea of the tasks they might be asked to undertake :—

Preparation of light refreshments
Serving of meals and washing up
Cleaning

Care of young children
Bed-making
Care of old people
Clerical work
Moving of furniture and equipment
Blackout (if lighting restrictions are imposed)
Heating arrangements
Sanitation
Messenger Service.

This list is far from exhaustive and the supervisor will, no doubt, think of many other suitable tasks.

28. Rest Centres in Operation

The main tasks which would have to be undertaken by the staff of a typical rest centre and the problems involved are set out below. This list is by no means comprehensive and there would be many other miscellaneous tasks to perform.

(i) *Opening*

The decision to open rest centres will normally be made by the Controller or Sub-Controller and will be passed on to those concerned by the Chief Rest Centre Officer or his local representative. If the established procedure proves to be impracticable in an emergency, the decision to open to meet an obvious need would be taken locally by the rest centre personnel themselves or at the request of police or wardens. In this event, every effort should be made to inform the Controller as soon as possible.

Standing arrangements will have been made in advance for opening each rest centre ; usually this will be the task of a caretaker or a member of the Welfare Section who lives nearby. The person deputed to open the rest centre should check that the water and other services (*e.g.*, gas and electricity) are functioning and if not, make arrangements for emergency provision. The next task would be to collect and arrange furniture and equipment, light up stoves for boiling water and heating (if necessary), prepare beds, etc. Although these tasks would normally be undertaken by the staff living nearest to the rest centre, all personnel should know how to perform the tasks involved in opening up a centre.

(ii) *Reception*

While an attack is in progress homeless persons should not normally be admitted to rest centres but should be directed to any shelters there may be nearby. After the all-clear has gone they must be admitted even if the rest centre is not in full running order. At this stage all the staff who are not engaged on essential tasks connected with the opening up of the centre should assist in receiving the homeless and making them as comfortable as possible.

The main object at this stage will be to satisfy immediate physical needs and the rest centre personnel's first task should be to find out what these are and to direct individuals to the right quarter, *e.g.*, lavatories, washrooms, sick bay, etc. They should then endeavour to get people seated and settled, in order that they may be given a hot drink as soon as possible.

Families will tend to stay together at first, but from the start a quiet corner will be needed for old people, and also somewhere for children to play.

co-operation of the householder. Points to emphasise to the householder are :—

(1) That she should understand the stark reality of the need and believe that her help is indispensable and is a valuable form of National Service.

(2) That while everything will be done to allocate evacuees likely to fit in no promise can be given as to the age, sex and characteristics of those who will arrive.

(3) That if the householder and the evacuee prove totally incompatible, changes may be effected through the Billeting Officer ; but every effort should be made to find a way out of the difficulties.

38. Billeting

When an organised party of evacuees is due to arrive the Billeting Officers will, so far as possible, match individual evacuees to available billets before setting out to billet them. All evacuees should be personally escorted to their billets, and introduced by name to the householder. If there is a very heavy influx some billeting authorities may consider it wise to billet in alphabetical order or some other equally arbitrary way, so that the less acceptable people are not left to the last, with a growing sense of inferiority and resentment, to be housed in the least willing households. As far as possible brothers and sisters should be billeted together, but when they have to be separated the children should be placed near one another and told at once of each other's address. On no account should householders be allowed to pick and choose either from the party in the reception centre or on the doorstep.

Whilst every effort should be made to billet people in private households it may be necessary on occasions to provide for a small minority of family groups who for some special reason cannot be fitted in elsewhere (*e.g.*, very large families refusing to be separated) in whatever communal accommodation the billeting authority has been able to set aside for this purpose.

In cases where at the outset there seems likely to be difficulty in settling in, Billeting Officers may feel it worth while to devote a little time to discussing with the householder and the evacuee the actual way in which they will arrange their life together. This may be particularly necessary in very small houses, or where social standards are widely differing. Although householders are not compelled to provide more for adults than shelter and access to water and sanitary facilities, Billeting Officers must help householders to recognise that billeted people will have wider needs than these and arrangements will have to be made for cooking, washing, etc.

39. Follow-up and Regular Supervision

For some days after the initial billeting, there are bound to be complaints and requests for transfer from householders, some reasonable and some the reverse. A recognised centre will be available from the start for dealing with these matters and will normally be the local authority's billeting office. Follow-up visits by Billeting Officers to all houses where people have been billeted will be necessary in order to see that all is well and to answer any questions that may

arise. Subsequently visiting at longer intervals should be arranged as necessary. Unaccompanied children should be visited within a week of arrival, or earlier still if for any reason this seems advisable. After that they should be visited regularly and in any case not less frequently than once a month. At the first visit the opportunity should be taken to make sure that the child is in touch with his school and with any brother or sister who is not billeted in the same house. Full advantage should be taken of the help that teachers accompanying school-children can give. They will know the children's personal idiosyncrasies, the importance of keeping members of the same family together, the home background of the children, and so on, and their advice will often help to simplify the problems of billeting. Teachers can also give valuable help in connection with follow-up visits. They should always be taken into consultation if a child becomes detached from his school unit.

Complaints must not be allowed to go unanswered, and so become magnified. In paying return visits, all Billeting Officers must be prepared to listen with patience to householders and evacuees alike, and to remain calm and dispassionate in the face of dispute. Every effort should be made to settle matters amicably, but if this fails they should report the case to the Chief Billeting Officer.

40. Neutral and Evacuation Areas

In neutral and evacuation areas, although no evacuees will be sent to them in the organised movement, the task will be no less difficult. These local authorities may have to billet, for long or short periods, those who are bombed out of their own homes and this work would be carried out amidst the dislocation caused by enemy activity and in districts where the number of billets available might be greatly reduced by bombing.

The aim of billeting in such neighbourhood is twofold :—

(1) To provide accommodation in the district for those who must remain in order to carry on their employment.

(2) To clear with the greatest possible speed any rest centres brought into operation as a result of enemy action. These rest centres must be cleared without delay, in order that they may be available for any further influx of people.

Billeting Officers in these areas should be fully informed as to the local facilities available for the giving of information, advice and assistance and be able to refer enquirers to the most appropriate centre.

41. Needs of Special Groups

(i) *Introductory Note on the Child and the Family*

In World War II the instinctive kindliness and sympathy of householders enabled them to give the majority of evacuated children a real home, and the friendship made then have in many cases lasted through the subsequent years. But one outstanding fact emerges from consideration of the experience then gained. This is, the importance of the family in a child's development and the impossibility of providing children with any completely adequate substitute for the care of their

own parents. All who have the task of visiting unaccompanied children in billets should understand, and be able if necessary to explain to others, the nature of this family relationship, since it illustrates many of the difficulties liable to occur in billeting and also points to some of the solutions.

In his family the child learns to live with other people and to accept the give and take of human relationships in every day life. For the very young child contact with his mother is the essential which provides for his need for affection and understanding. As he grows, his interest widens to include other members of the family. He learns their social habits, watches the behaviour of older members towards each other, and through his family begins to understand the life of the local community.

As he grows older his circle widens again to include school friends and neighbours ; his dependance upon close immediate contact with his parents becomes less but only because he has learned by experience that his family ties are sure and abiding. It is only with this knowledge that he can stand confidently on his own feet and become independent and responsible in an increasing measure for his own actions. Whatever he does and whoever he meets, his judgments have unconscious reference to his family and its attitude and standards. The family provides, in short, both security and the setting for activities which are the other essential in his satisfactory development. This is true save in exceptional circumstances no matter how poor the home.

All these things must be borne in mind when dealing with children removed from their own families and placed in strange households under the care of adults other than their own parents. Every effort should be made to preserve family contacts and to help both the parents and those who will care for the children after separation from home to recognise the importance of doing so and to consider how best these contacts can be maintained.

It is usually wise to talk to evacuated children about home and parents, and how they must be missing everything familiar, to put into words an understanding of the strangeness of new surroundings and their sense of loss. They may show more distress at first but they will have the consolation and support of knowing that someone understands how they feel, and this understanding will give them real help in bearing the separation. If a child is encouraged to talk about his parents, especially perhaps his mother, write to her, and later perhaps to make small presents to her, it will help further to preserve the essential link with home. If a child has brought with him from home some treasured personal possession, this should be respected, even though it may seem rubbish and valueless, because such things hold for a child the essence of home.

This practical understanding of the child's difficulties on the part of the householder must also include making the strange and unknown familiar, by taking trouble to show children their new surroundings, and to explain the new family's habits and way of life, while avoiding any disparagement of the ways to which they were accustomed. It must include too a recognition that children, or at any rate the younger ones, will normally show no sense of gratitude for all the kindness they may receive. Above all it must always be remembered that what a child will miss most will be home life.

Householders should not be expected to change their habits to fit their guests but only to realise that everything may be different for the child, and to act with patience and reassuring kindness. Many children can adjust very quickly to a new environment, but it is as well for the grown-up people to take the first steps to encourage the child to talk about his home and familiar background.

(ii) *Care in Billets*

It is clear that in the first place, every effort should be made to billet the child in a suitable household, if possible with similar standards to those of his own home. After that the aim should be to help him to settle into the life of the family and to take his share in their day-to-day tasks and pleasures.

It should be remembered that for health matters the children will be supervised by Health Visitors. It is important that Billeting Officers are well prepared for the work so that they are able to help householders and children to make any necessary adjustments, and if necessary help the householder to realise what separation from home must mean to each child, and how to deal with and minimise its effects. Some householders will be unaccustomed to the care of children, and visitors should be able to give general advice on such matters as diet, clothing and the amount of sleep required. They should be able also to judge the general health and well-being of the child and should make certain that sleeping arrangements are satisfactory, judged by the standard of the ordinary decent home. Contact with evacuated teachers, with whom the Chief Billeting Officer will establish close liaison, should be maintained since the teacher sees the child regularly, knows his character and may be the first to notice any signs of distress.

The intention is that orphans and other children deprived of a normal home life who were in the care of the local authority's Children's Committee before evacuation should be referred to the appropriate Children's Officer in the reception area for continued supervision on behalf of the evacuation authority. If Billeting Officers when visiting, come across such a child they should note his particulars so that the billeting authority can ensure that his whereabouts are known to the Children's Officer. Regular supervisory visits by the billeting authority will continue until the Children's Officer has confirmed that he will assume responsibility for keeping in regular touch with the child.

The visitor to the home should aim at being regarded by the householder as a source of friendly advice and practical help from whom information can be obtained, *e.g.*, where to obtain rubber sheeting for the bed-wetter or what local play facilities are available. Suggestions for help with sewing and mending may also be acceptable.

(iii) *Handicapped Children in Billets*

For handicapped children evacuated from Day Special Schools and considered fit for life in ordinary private homes, special efforts should be made to secure suitable billets in households where there is sympathetic understanding of particular disabilities, and evacuated teachers will of course have a particular concern for the well-being of their handicapped pupils. The Billeting Officer should therefore be especially careful to work in close consultation with teachers or with any other officer (*e.g.*, from the Local Education Authority) concerned.

42. Special Problems*

It is certain that after billeting has taken place difficulties will arise over some of the children. These may be caused by children who gave trouble in their own homes but had not proved to be difficult in school. Others may be due to children who, however well they are handled, may suffer from temporary emotional disturbance due directly to leaving home and parents, which may show itself sometimes sooner sometimes later, in various forms of difficult behaviour. This behaviour will, generally speaking, be of three types.

(1) Habit disorders, of which the commonest and least easily condoned is bed-wetting or daytime wetting and soiling. Sleepwalking, nightmares, excessive restlessness, twitching, are other examples.

(2) Behaviour difficulties which include aggressive behaviour such as temper, stubbornness, fighting with other children, swearing, etc. ; timid and fearful behaviour, excessive shyness, irrational terrors and so on ; and withdrawal and solitariness which may be described as unresponsiveness, refusal to make friends, or laziness.

(3) Delinquent tendencies such as pilfering (commonly of food), destructiveness, truanting or wandering, or sexual precocity.

In trying to help householders with any of these difficulties, it is no good trying to gloss over them, the very real trouble caused must be recognised, and whenever possible practical help must be forthcoming. In a minority of cases where there is seriously anti-social behaviour it will be only fair to the householder to arrange for a transfer to a suitable Home or Hostel forthwith.

(i) Bed-wetting

Bed-wetting or daytime wetting (enuresis) is likely to be one of the commonest difficulties met with. For the householder, immediate help will consist in the provision of adequate rubber sheeting, draw sheets and possibly additional changes of clothing, but this material help should be followed up by an imaginative attempt to ease the child's trouble. This may prove to be of long standing and difficult to overcome but in many cases a sympathetic talk may reveal that the trouble has been started or intensified by leaving home and may point to some particular explanation. It is known, for instance, that some town children are scared of going to an outside closet, especially in the dark. Sometimes a nightlight or a dim light in the passage or on the stairs may encourage a child to get out of bed and use the chamber pot. A chat with the billet mother may create a more understanding attitude which in itself may help the child to throw off the habit.

The causes of bed-wetting are so many and complex that no advice applicable to all cases can be given. The whole character and constitution of the child must be studied. In a minority of cases there may be some definite physical cause requiring medical treatment, while some children, especially backward children, are late in learning bladder control. It is important to recognise that many children wet their beds for emotional reasons. This accounts for the amount of attention which had to be given to the problem of bed-wetting among children evacuated in the Second World War.

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* *Note :* These paragraphs do not apply to a child whose supervision has been taken over by the Children's Officer. (See paragraph 41 (ii)).

The psychological processes are complicated and it is impossible to give a short and adequate non-technical explanation. Briefly it can be said that fear of strange surroundings, a feeling of not being wanted, loneliness, and hopelessness about the habit are the most common features. These are based on a sense of insecurity, possibly aggravated by separation from the family. The child would not as a rule realise or be able to explain the nature of his difficulties. It is clear that the wisest treatment for each individual child cannot be decided until he is known and understood. A happy and reassuring environment with good food, plenty of sleep, and daytime interests will have its effect on a child's whole personality and the symptom very often quickly disappears if the difficulty is not deep rooted.

The attitude of adults who have the care of the child makes a great difference to whether the trouble persists. Since the child may be fearing scolding, punishment or blame, or may be hoping for attention and fussing, it is important that adults dealing with him or with the wet bed should be matter-of-fact and not exhibit anger, disgust or anxiety. There should be no punishment or social stigma attached to the bed-wetting, since this is liable to make the trouble worse. On no account should a child sleep in a wet or dirty bed ; wet sheets should be removed and washed. It is a good plan to keep a record of "wet" and "dry" nights as this enables the householder to judge the progress being made and will greatly encourage the child who is improving. Each child will respond to different methods. For some, particularly those who have been slow to achieve bladder control, rousing may be useful for a time, since they may need the kind of training and encouragement which would normally be given to a younger child, but rousing will not prove helpful for all children. There is nothing to be gained by making an unreasonable restriction of drinks, though it is undesirable that any child should drink large quantities just before going to bed, and especially that a child given to bed-wetting should do so.

There is no golden rule for dealing with bed-wetting. The aim must be to give the child a sense of security and to try to build up his confidence in himself. Experience in the last war showed that there are many kindly people who, given the right kind of advice and support, will accept with sympathetic interest the responsibility of a child who wets his bed, will undertake the extra work involved and feel proud and pleased at the gradual improvement with which their patience is often rewarded.

(ii) *Other Problems*

For a very restless child it may be helpful to provide games or occupations which will be interesting enough to command concentrated effort or to link him with some play group outside ; for the shy child to let him help in some light domestic occupation or in the garden may give him the confidence that comes with feeling wanted. It will be realised that some young children who use bad language are not deliberately swearing but merely imitating adults and that this is not a matter for punishment but for re-education. For older children the provision of group activities not only games, but outings and expeditions, and interesting, co-operative jobs that carry some responsibility may help to keep them out of mischief. Whatever the nature of the help visitors can give, they should always discuss its purpose with the householder from the point of view both of easing her difficulties, and of encouraging the children to socially acceptable

behaviour. Their aim should be to promote willing co-operation and to give the householder sufficient understanding of the child's problem to prevent her from feeling unduly responsible for what has occurred. The householder whose sympathy has been aroused will also understand that satisfactory adjustment to the new home is bound to take time, and that transfer to a new billet may relieve her but will more often than not make matters worse for the child.

Re-billeting or admission to a hostel will be necessary in some cases but should not be undertaken lightly. Constant changes of billet sometimes had the effect in the last war of turning the comparatively normal child into a chronic misfit labelled " difficult " or " unbilletable." Where the billet environment is helpful but the difficulties do not clear up in a reasonable time, more expert help should be sought, *e.g.*, through seeking medical advice or through the local Child Guidance Service in consultation with evacuated teachers.

43. Contact with Parents*

The need for maintaining effective contact with parents has already been stressed. This is not only essential to the child, but is also important to the householder, because a parent's apparent lack of interest may cause great irritation and, at the worst, a loss of goodwill towards the child himself.

Good householders and many parents will get into touch at the outset and will settle between themselves all matters relating to the child's welfare, clothing and pocket money. Some parents are, however, casual about keeping in touch. Their failure is not always due to lack of affection. Many people find difficulty in writing letters while others, because they feel they cannot meet requests for clothing and pocket money, take the line of least resistance and do not write either to the householder or to the child. In such cases, the possibility of arranging for an understanding visitor to call on the parents and persuade them to keep in touch should be explored in consultation with the Chief Billeting Officer and the evacuation authority.

It is essential that proper arrangements should be made to keep the parents informed of the general condition and progress of the child, and of any particular needs. If the householder, for some reason, fails to undertake this herself, it will be necessary for the Billeting Officer, teacher or some other responsible person to ensure that it is done. In particular, it will be for the billeting authority to see that prompt and tactful notification is sent to the parents if the child is ill or is for any reason in serious trouble. Notification of any change of billet should also be made.

Parents will remain responsible for clothing their evacuated children and for providing them with pocket money. Children's clothes should, therefore, be regularly looked over and parents should be informed in good time about repairs and replacements required. Particular attention should be paid to the early repair of boots and shoes, and to the need to provide mackintoshes and the sturdier clothing which is generally more suitable for country life.

Arrangements will have to be made to deal with the situation which arises when parents lose touch, or do not respond to letters. The Chief Billeting Officer may be able to arrange with the evacuating

**Note :* These paragraphs do not apply to a child whose supervision has been taken over by the Children's Officer. (See paragraph 41 (ii)).

authority for the parents to be visited, but if this fails, the billeting authority should arrange for the necessary articles to be supplied. In cases of real need, the local education authority in the reception area has power under the Education Acts to supply clothing for school children who are inadequately or unsuitably clothed. The householder on whom the child is billeted should not be expected to bear this expense.

It was found in the last war that visiting by parents and relatives, if they came very frequently or in great numbers, caused trouble in billets. For the most part, the householder accepted this additional burden with kindness and hospitality, but in some reception areas it was found convenient to open special centres on Sundays to provide a meeting place for parents and children, where they could take their meal and where hot drinks could be provided. Where large numbers of children are billeted in urban areas, billeting authorities may again consider such centres desirable in which case their organisation and staffing will be likely to be a task for members of the Welfare Section.

44. Out of School Activities

Children cannot be good if they have nowhere to play, and it will in most cases be necessary to provide some facilities for play and games outside the billet. This is a matter on which the billeting authority may usefully seek the help of the local education authority's Youth Service Organisers and any local voluntary organisations. Evacuated teachers, although not primarily responsible, no doubt will also willingly give their help.

Existing clubs and play centres may need to be expanded or new ones improvised, with members of the Welfare Section helping to provide the staff. Children who already belong to Scouts, Guides and similar organisations should be linked up in the new area and other children encouraged to join where this is appropriate.

Members of the Welfare Section working as Billeting Officers may also be ready to organise country walks and picnics as a way not only of relieving householders but of getting to know the children better. There is a particular need for special arrangements at week-ends and during school holidays. Older children should be encouraged to take their share in the war effort *e.g.*, by helping to grow vegetables on allotments, engaging in salvage drives or helping in whatever the special need of the moment may be. The teachers will be responsible for the children during the whole of normal school hours even where schools are working a double shift system.

45. Sick Bays and Hostels

A minority of children on reception will require temporary care in sick bays or hostels, generally because they need short-term medical treatment, *e.g.*, for minor ailments, dirty heads, and so on. As already stated, the reception authorities will plan ahead to provide, equip and staff the premises and members of the Welfare Section may be asked to assist or to take charge.

One or more of these hostels may later be converted for short stay use to meet for instance, sudden emergencies in billets involving the immediate transfer of a child. Hostel requirements will vary in different districts, but the length of stay of each child should be kept to a minimum.

children. In the same way, many towns-women have, through evacuation, acquired experience of country habits and learned to put up with the less convenient types of sanitation, heating and lighting. This knowledge and experience should help each side to be more tolerant. The billeting staff can help in a friendly way to promote their understanding and to secure the give and take required for peace between two women sharing a home.

A lesson to be learned from the last war is that where two women must share accommodation, it is better to work out a plan of living from the very beginning. The goodwill which at first prompted the housewife to cook for the new arrivals turned later to annoyance or worse when the evacuated women failed to make any effort to provide meals herself. "Start as you mean to go on" is a good maxim. How the kitchen can be shared, what equipment may be used and when the newcomer will do her washing will depend on the type and size of the house, and the Billeting Officer may be able to help the householder and evacuee to decide these points. If an oil cooker can be obtained or other separate cooking arrangements made this will be better than sharing the kitchen cooking facilities.

The process of adjustment to new conditions will be facilitated if the mothers have means of occupying their time profitably. Their first responsibility will be to care for their own children, clean their own rooms and see that extra burdens do not fall on the householder, but many will have time to spare for part of the day and will wish to undertake work likely to forward the national effort. With this end in view it might be desirable to encourage the mothers to form themselves into groups to help each other, so that some of them might be enabled to take up part-time or full-time employment. Their help with domestic duties, mending and possibly gardening in hostels for evacuees could also be encouraged.

In districts where large numbers of mothers are billeted, such schemes will be facilitated by the provision of centres for the day-time use of mothers and young children. These centres will also help to give relief to householders and will make a useful headquarters for voluntary work in aid of the war effort. During the Second World War, such centres were established in many districts and provided facilities for washing and ironing, bathing and cooking, rooms for sewing and mending and rooms for the care of young children. Simple talks on first-aid and child-care were given as well as lessons in "make do and mend," and recreational activities were also arranged. These centres often function best when run by a committee on which the evacuated women were well represented. In many places, such organisations as Women's Institutes, Co-operative Guilds and Mothers Unions extended a warm welcome to evacuees and provided an introduction for these new neighbours.

48. Expectant Mothers

In the ordinary way, evacuated expectant mothers will be billeted on private householders in the reception area. As far as possible, they will be billeted in areas where Regional Hospital Boards are able to provide lying-in accommodation. After the lying-in period mother and child will again be billeted. Women within a month of their confinement will not as a rule travel by train with the organised parties of mothers and children but will travel by road to the reception areas. The billeting authorities will set up hostels for expectant

CHAPTER V

WELFARE IN SHELTERS

55. General

Home Office Civil Defence Circular No. 48/50 gives guidance to local authorities on planning for the provision of air raid shelters for the public. It is probable that members of the Welfare Section will be asked to assist local authorities with the supervision of public shelters and to help with particular aspects of the welfare of shelterers. The following notes have been based mainly on the experience of the last war and may need modification in some matters of detail when the shelter programme takes shape.

In all large shelters there will be appointed one or more supervisors who may be members of the Welfare Section and whose duties will be concerned with the following matters :—

(1) Arrangements for the safety, comfort and convenience of the public.

(2) Regulation of bunks, settlement of disputes about allocation, and care of fitments.

(3) The proper use of the sanitary arrangements provided.

(4) The cleanliness and tidiness of the shelter and the arrangements for the collection and disposal of litter.

(5) Regulation of entertainments and of noise, including the use of radio sets, gramophones and musical instruments.

(6) The use of heating, lighting and emergency lighting.

(7) First aid arrangements.

(8) The use of the canteen, if any, and of the water supply.

(9) Administration of any rules made for the management of shelters.

56. Shelter Committees

It will generally be found that the supervisor will be assisted in this work if a Shelter Committee is formed, and a certain amount of responsibility placed on the shelterers themselves. Such Committees, which the supervisor should attend, will help to promote a good atmosphere and to weld the group into a community. They will decide upon the type of activities which they wish to adopt, listen to complaints from individual shelterers, make suggestions, and, if possible, carry them out with regard to cleansing, supervision, etc., settle disputes, make local rules for the benefit of their shelter community, and generally encourage a form of self-government amongst themselves. The "self-help" atmosphere brought about by these Committees is most desirable and should go far to ensure that regulations made to secure the health and well-being of the group are effective.

(i) *Children.* Where space is available, play groups can be arranged and for these simple play material for children of varying ages will be required, such as chalks and drawing paper, modelling clay, toys suitable for use in a confined space, and picture books for very young children. Books for the older children can probably be obtained on loan from the local library and responsible children asked to take charge of them. Local churches, Settlements, Boys' and Girls' Clubs, W.V.S., Scouts, Guides, etc., may all be able to provide helpers for activities and special club nights for one or other organisation to be held each week. Singing and story-telling are always popular.

The Shelter Committee should make local rules as to the bed-time hour for children of various ages, and secure the co-operation of parents in carrying them out. They will probably find that preparation for sleep under shelter conditions is very necessary and may be able to arrange small quiet groups for bed-time stories, simple prayers, etc.

(ii) *Adolescents.* Much can be done for adolescents through the good offices of Young People's Clubs. Club Leaders should be given whatever facilities are possible in order to have free access to the boys and girls. Evening Institutes can provide lecturers on almost any subject and it may be possible to form study groups ; contact should be made with the local education authority who will be able to give help and advice.

(iii) *Adults.* The majority of shelterers will belong to this group, and in planning activities in a shelter too much attention must not be given to pleasing minorities. Activities undertaken and arranged by the shelter users themselves for their own amusement should be encouraged, and the possibility of providing an occasional concert or film show should not be forgotten. The Central Office of Information may be able to assist with regard to the supply of films. Books and magazines are always useful and library facilities should be provided where possible through the normal library service.

(iv) *Old People.* The Shelter Committee will probably find that advice and help will be welcomed by old people. Every effort should be made to put them in touch with appropriate voluntary organisations with a view to private arrangements being made for their evacuation from the target area.

62. Welfare in Communal Shelters (*i.e., Surface Shelters, Trench Shelters and Shelters in Buildings*)

In areas where a number of communal shelters are in use much can be done to promote a neighbourly atmosphere. Members of the Welfare Section should visit these shelters in a friendly way, bearing in mind that each one is shared by one or more families, that they have their own key to their own shelter and that shelters of this type are not "public." It will be found that, generally speaking, such visits will be welcomed and that very definite help in the way of new ideas for comfort and recreation can be imparted to the families concerned.

CHAPTER VII

EMERGENCY FEEDING

76. Object

It is necessary as part of the Civil Defence preparation to make arrangements for feeding people who may be unable to get meals as a result of enemy action. The Ministry of Food has central responsibility for emergency feeding arrangements of this kind, but each local authority designated as an emergency feeding authority (see Chapter I) has the responsibility of planning the organisation of an emergency meals service within its area.

77. Local Plan

The plan prepared by the emergency feeding authority must provide for :—

(*a*) full utilisation of all resources within the area ;

(*b*) the encouragement of individual initiative particularly in the way of improvisation ;

(*c*) mutual aid, and

(*d*) the use of supplementary cooking equipment to be provided by the Ministry of Food.

Each emergency feeding authority will plan to meet its own needs, if at all possible, from local resources but the plan must also provide for mutual aid between adjoining emergency feeding authorities. The regional and national plans are being prepared to ensure that help can be given to any area unable to deal with its own problem.

Each emergency feeding authority has already taken action in the following matters :—

(*a*) appointment of emergency meals officer ;

(*b*) survey of cooking facilities in the area ;

(*c*) selection of premises for earmarking for use as emergency meals centres ;

(*d*) storage accommodation for Ministry of Food training equipment ; and

(*e*) arrangements for training.

78. School Meals Service

It has been agreed that the school meals service by virtue of its organisation and capacity, will form an essential part of the emergency feeding service of the country. It will be made available for this purpose in time of war on the understanding that school feeding would be continued as far as possible and, if interrupted, would be re-established when conditions permit.

79. Catering Industry and Industrial Canteens

Caterers, because of their experience and resources can make an important contribution to emergency feeding both in the planning

and operational stages and catering liaison officers are being appointed to all emergency feeding authorities. The full co-operation of the industry in these matters can be confidently expected.

It is important that industrial canteens should be able to continue in action without placing a burden on the emergency feeding service and that caterers should be able to continue to serve meals to the public even if their normal cooking equipment were temporarily out of action as a consequence of a raid. Accordingly, the workers in industrial canteens and in the catering industry should be trained in emergency cooking. This work is being undertaken by emergency feeding authorities.

80. Improvisation

Special emphasis in training and in planning is being laid upon the value of improvisation. To be fully effective there must be prior planning and training and in appropriate cases it may be well worth while to make some simple inexpensive preparations in advance. Information on this subject is contained in Appendix A to Pamphlet No. 2A—WELFARE SECTION (Emergency Feeding), but a special booklet on improvisation suitable for dealing with large numbers of people has been issued as Pamphlet No. 2B—WELFARE SECTION (Improvisation of Large Scale Cooking Equipment).

81. Training

Emergency feeding authorities have already made arrangements for training. The importance of training in all aspects of emergency feeding cannot be over-emphasised. There are many who can cook meals to-day with the help of modern appliances. We must have many able to cook with very primitive aids. Only the trained person—the person who has learned by experience to organise and to use her hands—will be able to rise to the occasion with promptness and efficiency should the need ever arise.

82. General

For a more detailed description of the plan for emergency feeding and the nature of the training and for details of the reserve equipment including Food Flying Squads held by the Ministry of Food, reference should be made to Pamphlet No. 2A—WELFARE SECTION (Emergency Feeding).

NOTE ADDED: See the 1960 Civil Defence Handbook No. 8, "Emergency Feeding", for improvised mass feeding techniques (this handbook 8 is 127 pages in length)

APPENDIX D

Care of Domestic Pets

It is pointed out that first-aid for injured animals should be based entirely on the advice given by the R.S.P.C.A. and similar societies and consequently no reference is made to it in this summary.

Dogs should be muzzled as a safeguard and kept on a short, strong lead. Household pets can be taken into a private shelter but not into a public shelter.

If a dog becomes highly nervous when alarms are given or loud explosions occur, immediate relief from nerve tension can often be secured by giving one or two 5-grain tablets of aspirin. One tablet is the correct dose for small breeds. A terrier takes 10 grains and large breeds 15-20 grains. To obtain immediate sleep it is necessary to have at hand drugs that can only be obtained from veterinary surgeons. Animal owners should be advised to consult their veterinary surgeon as to the dose, and to keep the drug under lock and key when not required.

Bromide drugs are feeble in action and have to be given repeatedly for several days before their effect is of any value.

Injured animals in pain revert to the wild state and can cause severe injury even to those to whom they are deeply attached. Owners should learn the simple methods of restraint, such as the tape muzzle on the nose of the dog, the method of getting a dog on to a coat or blanket for carrying with the minimum of pain to a broken limb.

Nothing communicates itself to an animal quicker than human fear or apprehension. A quiet calm approach with soothing tones does wonders with an hysterical animal in pain. The voice is of the greatest value and if the speaker is the owner and the voice is known, this is an advantage. Hysterical outbursts of sympathy are the worst possible environment for patients.

Many questions are bound to be asked relating to the effect of war gases on animals. Tear and nose gases are not now regarded as likely to be used in war, and in any case these have little effect on animals even when humans are quickly overcome. Choking and blister gases are most likely to cause severe suffering and death. Nerve gas acts very quickly and exposure to a high concentration is likely to result in immediate death. In non-fatal cases if an animal has been seriously affected there is at present no known treatment which could be applied in time to be effective.

Past experience has convinced the R.S.P.C.A. that gas-proof boxes or kennels are not a practical proposition for various reasons. Where a private shelter is used, owners of dogs and cats should have a sleeping basket and an ordinary woollen blanket available, so that in the event of a raid, the animal can be taken to the shelter complete with basket and blanket. If a gas warning is given, the animal should be placed in the basket and the whole covered with a blanket soaked in water, or better still a solution of sodium bicarbonate (baking powder), a teaspoonful to the gallon.

Birds are extremely susceptible to gas and, if contaminated, would undoubtedly succumb to its effects. A blanket soaked in a solution of bicarbonate of soda and placed over the cage will afford some protection.

APPENDIX E

Information Centres : Services which may be represented

Department or Authority	*Service normally rendered at Local Office*
Ministry of Pensions and National Insurance	(1) Claims to National Insurance Sickness Benefit ; Retirement Pensions; Widows' Allowances and Pensions ; Guardians Allowance ; Maternity Benefit ; Death Grant. (2) Claims to Industrial Injuries Benefits and for Civilian War Injuries. (3) Claims to Family Allowances. (4) Replacement of lost Pensions and Family Allowance Order books and lost Insurance Cards.
Ministry of Labour and National Service	Claims to Unemployment Insurance Benefit ; recruitment for H.M. Forces and Civil Defence ; all questions of employment.
National Assistance Board... ...	Applications for national assistance by persons in need, including, for example, supplementation of Insurance benefits and pensions ; payments pending the issue of benefits or pensions ; payments to persons not qualified for benefits or pensions ; non-contributory old age pensions and blind pensions and payments to supplement such pensions ; payments to any other persons in need not otherwise provided for ; replacement of national assistance or non-contributory pension order books lost or destroyed.
Ministry of Food	Issue and replacement of Ration Books.
Local Authority (County, County Borough or County District Council, as appropriate)	Billeting and rehousing ; salvage, removal and storage of furniture ; first-aid repair to houses ; evacuation (in evacuation areas) ; emergency meals.

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HANDBOOK No. 8

EMERGENCY FEEDING

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EMERGENCY FEEDING

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CHAPTER 1

The Emergency Feeding Plan

Introduction

1 The object of the plan is to feed members of the civil population who, owing to hostile action or the threat of hostile action, are unable to provide meals for themselves.

The need for emergency feeding

2 The threat of nuclear warfare necessitates a comprehensive national plan for emergency feeding. There already exists a large and efficient catering industry and an efficient school meals service ; also most large works have their own catering facilities. Apart from the risk of extensive damage to these potential sources of meals, the fact remains that by far the majority of catering establishments of all kinds depend upon gas and electrically operated equipment for cooking. Furthermore, the destruction of many homes and the disruption of gas, electricity and water services may result in many people being without the means of cooking in their own homes and being unable to use alternative catering facilities. All these people, whether they usually eat at home, at work or at a restaurant, will be unable to obtain meals unless suitable arrangements are made.

3 Moreover, it is to be expected that there will be large and unpredictable movements of people, and that the density of population in many areas will be increased to an unprecedented degree ; this could well throw an impossible burden upon the normal catering facilities in those areas, even if gas and electricity supplies were not disrupted.

The national plan

4 Under the Civil Defence Act, 1948, the responsibility for emergency feeding arrangements in England and Wales is placed on the Minister of Agriculture, Fisheries and Food and in Scotland on the Secretary of State. So that the best use could be made of the available resources in any locality, certain responsibilities have been passed on to the larger local authorities (county councils and county borough councils in England and Wales and the councils of counties, joint counties and large burghs in Scotland). There are 195 of these authorities (known as Emergency Feeding Authorities) each of which has appointed an Emergency Meals Officer to carry out the emergency feeding arrangements for which the authority is responsible. Emergency Feeding Authorities may, with the consent of the Minister or, in Scotland, the Secretary of State, appoint other local authorities as their agents to carry out any arrangements in connection with emergency feeding. Arrangements have also been made with the Northern Ireland Ministry of Home Affairs for the Ministry of Agriculture, Fisheries and Food to organise emergency feeding services in Northern Ireland on lines generally similar to those in Great Britain.

Equipment

7 Reserves of mobile equipment which are held by the Ministers consist of No. 4 field cookers, Soyer boilers, insulated containers and camp kettles (dixies). Some supplies of equipment have also been issued on loan to Emergency Feeding Authorities for training purposes. In addition, there are Food Flying Squads under the control of the Ministry's Regional Controllers and the Department of Health for Scotland. These are operated by members of the Women's Voluntary Service who are also members of the Welfare Section of the Civil Defence Corps. The total cooking capacity of the stockpile of emergency feeding equipment, i.e. equipment held in reserve, issues to Emergency Feeding Authorities, and Food Flying Squads, is 6 million emergency meals consisting of soup and stew, or 1½ million normal type main meals at one cooking.

Improvisation

8 Although the above mentioned reserve of equipment is stored at a number of places situated away from obvious target areas it may prove difficult, owing to the dislocation of transport facilities and the incidence of "fall-out", to make it available where it is most required following attack. Furthermore, it may prove in the event that the reserve is inadequate to meet the ultimate need. In order to guard against these possibilities much emphasis is placed upon the need for emergency feeding personnel to be familiar with means of improvising cooking equipment, and instruction in the construction and use of emergency cookers forms an important part of their training.

Premises

9 All Emergency Feeding Authorities have conducted a survey of premises suitable for use as emergency meals centres in their area and have records of cooking and seating capacity for use in case of need.

Training

10 In addition to the training being given to local authority personnel (largely the School Meals Service) and to civil defence personnel, many Emergency Feeding Authorities are also providing training in improvisation for commercial and industrial caterers, the catering staffs of hospitals and other institutions and of the nationalised industries.

Exercises

11 It is the Ministers' policy to encourage the organisation of exercises at which the members of the Welfare Section trained in emergency feeding can demonstrate their abilities in using the standard equipment provided and in the construction and use of improvised equipment. Every opportunity should be taken of arranging exercises calling for the use of emergency cooking equipment, both manufactured and improvised, to cook food for schools, old people's lunch clubs, territorial and cadet camps, and similar large groups. In this way exercises become much more realistic and meals will be prepared and cooked on a fairly large scale. This will serve to foster team spirit and to develop powers of decision, imagination and initiative in all members of the team. Every opportunity should be seized of taking part in combined Civil Defence exercises.

CHAPTER II

Manufactured Equipment

Equipment held in reserve

13 The reserve stock of transportable cooking equipment is held by the Ministry of Agriculture, Fisheries and Food and the Department of Health for Scotland in depots throughout the country for issue to Emergency Feeding Authorities when necessary. It consists of simple, well-tried, cooking apparatus designed to produce large quantities of tea and soup—particularly in the first phases of the feeding operation—and later the more substantial type of meal when conditions become more stable. The cookers are mainly Soyer boilers and No. 4 field cookers which are robust, use hard fuel and are extensively in use by the Army and Royal Air Force.

14 When meals are cooked they must be kept hot until they are served. Insulated containers as used by the School Meals Service and industrial canteens to send hot meals in good condition to distant feeding points are therefore included in the reserve stock.

THE SOYER BOILER

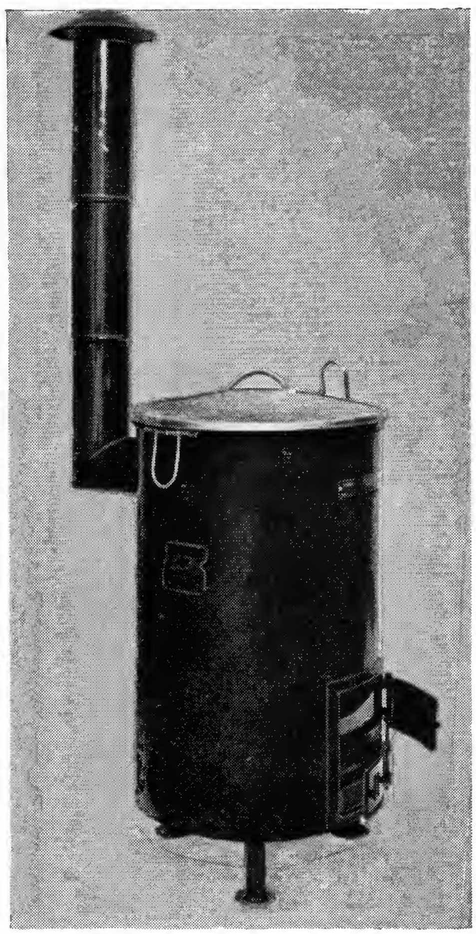


Fig. 1

15 The Soyer Boiler was first used by its inventor Alexis Soyer, a noted French chef, for emergency feeding purposes during the potato famine in Ireland over a century ago. It is a portable copper of 10 gallon working capacity of all metal construction (Figure 1) suitable for boiling water and vegetables, making tea, porridge, soup and stews.

21 In favourable weather conditions, 10 gallons of cold water may be brought to the boil in about three quarters of an hour using 10 lb. dry chopped logs, or in about one hour using about 5 lb. wood with 4 lb. coal.

CHAPTER IV

Improvisation in Emergency Feeding

NOTE. Although a number of the Figures in this chapter show bricks laid with frogs uppermost (standard building practice), it is generally accepted that for improvised building purposes it saves pug and speeds the building operation if bricks are laid with the frogs down. A "frog" is the indentation in a brick.

Why improvisation is needed

115 It is impossible to foresee exactly where an attack would occur or to gauge its consequences as regards the number of people who would require emergency feeding services. The demand would almost certainly be beyond the facilities normally at the authority's disposal. Although manufactured equipment is held in depots throughout the country, transport would probably be difficult to arrange at short notice to get the equipment to selected sites. Moreover, the stock is necessarily limited. Improvisation is therefore necessary to meet the deficiencies brought about by the loss of normal facilities and to supplement the capacity of the manufactured equipment

What improvisation can achieve

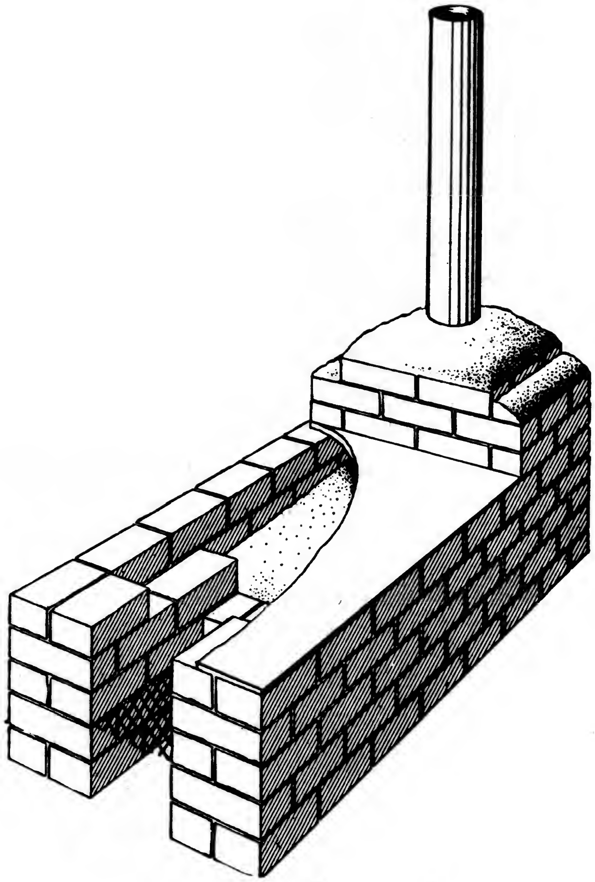
116 A wide range of efficient cooking appliances and other equipment can be built by using bricks, sheet iron, pipes, metal drums and many kinds of scrap materials. Improvisation is not confined to small scale catering ; some of the cookers described in this chapter are capable of cooking for large numbers. Anyone trained in the methods described will be able to make a useful contribution to emergency feeding in war and the skill of the trained staffs of the School Meals Service, commercial caterers and industrial canteens will be particularly valuable.

IMPROVISED COOKERS

Simple types of improvised cookers

117 The simplest form of improvised cooker is a fire on the ground between two bricks which support some kind of boiling pot.

118 This simple device may be enlarged to take more than one cooking pot by adding bricks to form two walls, three bricks high, between which the fire is laid. The distance between the walls is governed by the size of the pots to be used. Lay the bricks in the direction of the wind to maintain as good a draught as possible through the fire. If the wind changes direction separate the bricks to restore the draught. Both large and small cooking pots may be accommodated by building the walls closer together at one end. There are obvious practical defects in these simple types of cooker—loss of heat, dirt, ineffectiveness in wet weather and difficulty in controlling the fire which quickly becomes choked with ashes—but they will serve in an emergency.



IMPROVISED
HOTPLATE
COOKER

Fig. 21

Materials required to build the hotplate cooker

122	Bricks	— Whole bricks should be used wherever possible. *Do not use glazed bricks, blue bricks or concrete blocks for building any part of the fire box or ashpit. They may burst when heated and cause serious injury.*
	Pug	— A stiffish mixture of sifted soil and water.
	Fire grate	— Heavy gauge mesh known as "expanded metal" is ideal. Other suitable materials are : sheet metal well perforated, such as may be cut from an oil drum or corrugated roofing sheet ; discarded grating ; boot scraper (grid type) ; domestic fire bars ; iron or steel grate with openings preferably not more than one inch wide. The material chosen should not be too thick.
	Hotplate	— A flat metal sheet of suitable size. Corrugated iron can be used if a flat sheet is not available.
	Supporting bars	— Iron bars or flat pieces of steel about the same length as the width of the hotplate.
	Chimney	— The pipe selected for the chimney should not be less than 6 inches nor more than 9 inches in diameter, and should be as long as the total length of the flue. A salvaged light metal stove pipe is the first choice, alternatively tins with their ends removed may be fastened together as described later. *Avoid using asbestos, cast-iron or glazed earthenware pipes as they are liable to explode under heat.*

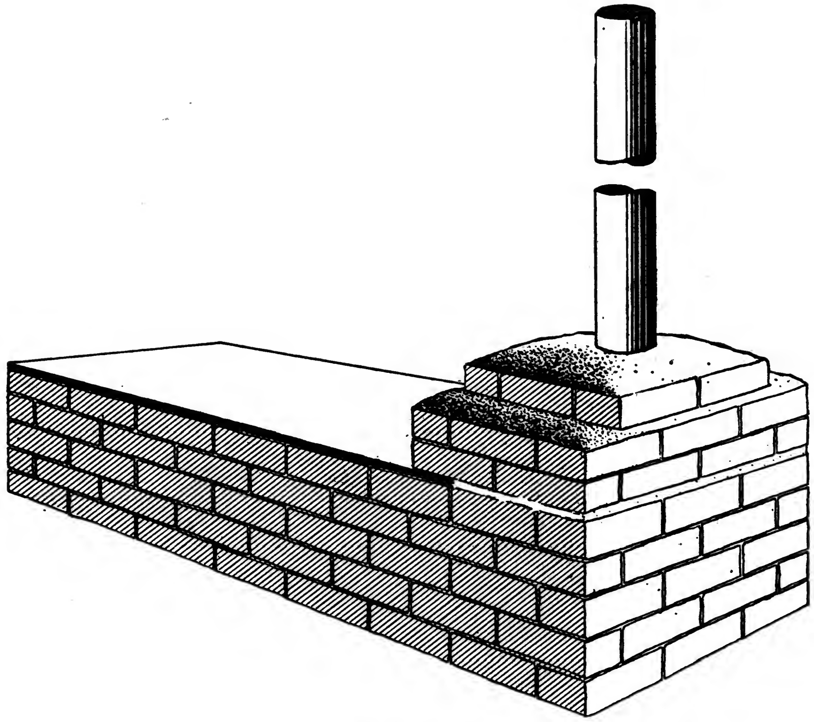
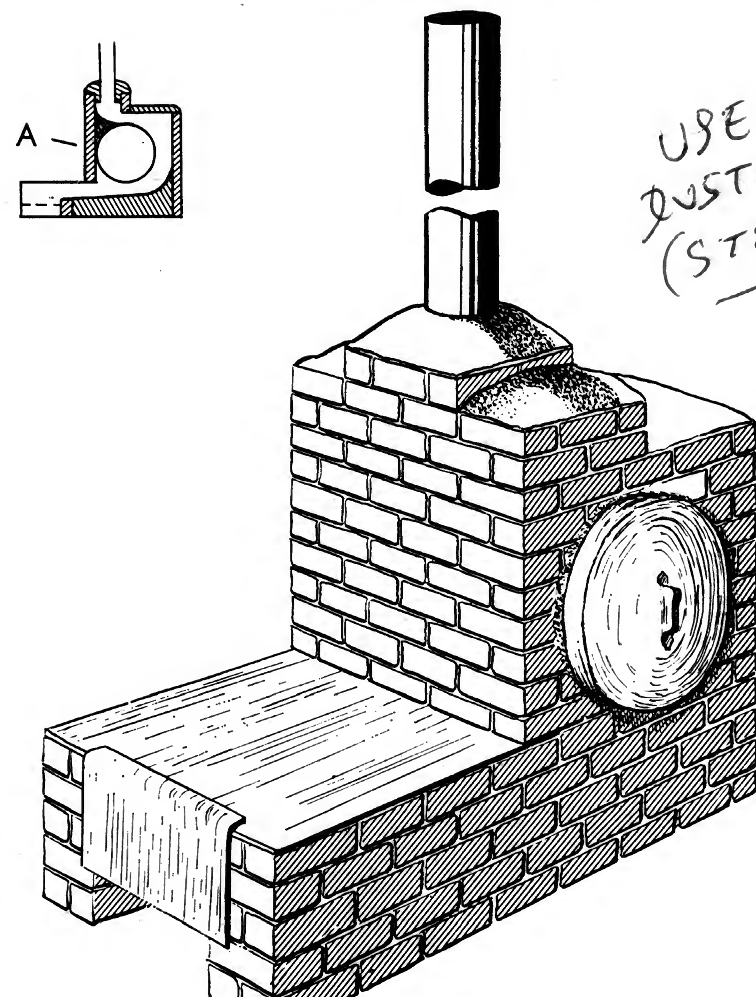


Fig. 42



USE OF DUSTBINS (STEEL)

Fig. 43

Note : Galvanised dustbins or drums which are brought into use for the first time in improvised cookers should be " burned out " by slightly overheating and then thoroughly brushed out before food is cooked in them. This will avoid the possibility of flakes of zinc oxide—which form when galvanised metal is heated—falling on to the food.

147 This cooker is used for baking, roasting and boiling. A small dustbin built into the cooker will take two standard baking trays and will roast 120 portions of meat ; a larger type will take four trays. A 40/50 gallon steel drum oven will take four standard baking trays on the upper shelf and two on the lower shelf. A tray holds two 7 to 8 lb. joints boned and rolled which will provide about 60 portions. The roasting capacity of the oven is therefore 360 portions.

How to mark out and build the single drum oven

148 Lay down the plate and the drum on its end on the selected site. Place two bricks together beside the drum as shown in Figure 44. The brick touching the drum indicates the space for the rising flue at the back of the oven, and the other the line of the rear wall. Place one brick in the line of the rear wall and put down a line of bricks along one side of the assembly. Mark on the ground the positions of the side wall, the rear wall, and the plate at the fireplace end.

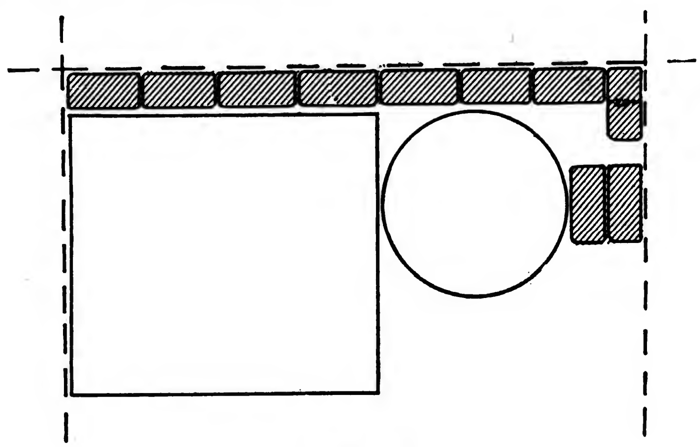
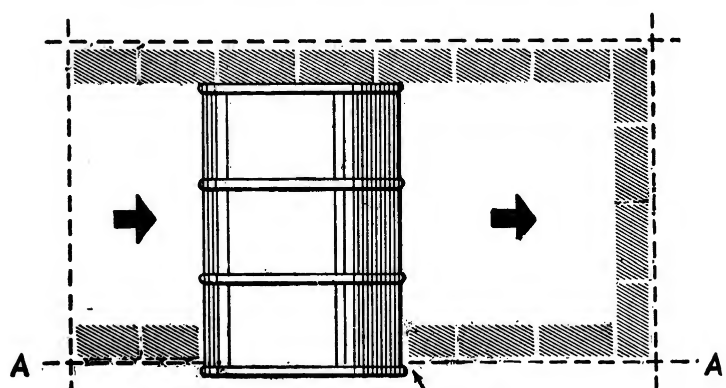


Fig. 44

149 Remove the plate and then proceed to determine the position of the second side wall. To do this, place the drum on its side with one of its ends touching the inside of the side wall already laid down. Run the drum along the cooker bed, marking the line of the second side wall as shown by the dotted line A-A in Figure 45. Lay a line of bricks inside this line, allowing for the fact that the drum has to protrude sufficiently from this wall to enable a lid or oven door to be fitted. Complete the line of bricks for the rear wall.



Bricks at least 1" from rim

Fig. 45

150 Construction then proceeds similarly to the method for the hotplate cooker previously described except that a brick pillar is erected to support the closed end of the drum. Construction above the fifth course is shown in Figure 46. (More pug may be added to the upward curve at the chimney end of the cooker and shaped to follow the contour of the drum so that the width of the flue remains constant.)

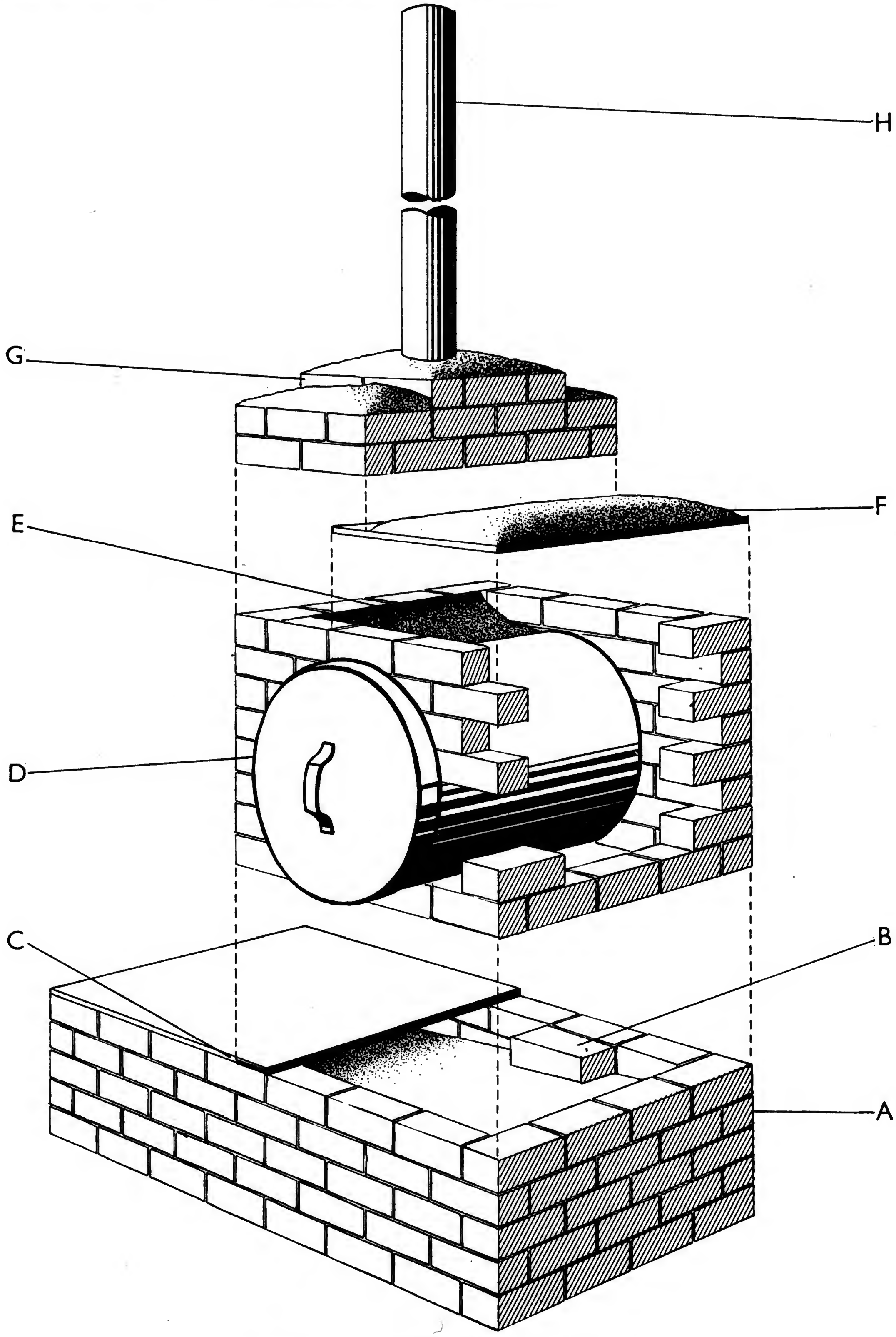


Fig. 46

151 In Figure 46, A shows the base. The plate is short enough to leave room for the oven.

B — is the brick support for the end of the drum.

C — shows the stout metal bar, and the point where construction of the upper brickwork starts. Care should be taken to preserve the bonding.

D — shows that bricks have to be shaped to fit the curve of the oven. Fill in gaps with pug.

E — shows the space between the oven and the front wall filled with pug shaped to deflect the smoke into the chimney.

F — shows a metal plate covered with pug sealing the space above the oven.

G — is exactly similar to the chimney-base previously described for the hotplate cooker.

H — is the chimney. It is important to build a really good chimney into any oven cooker. The length of the flue along the base and up around the oven to the foot of the chimney may be eight to nine feet. The chimney ought to be at least of the equivalent length, and not less than six inches in diameter. Too often the efficiency of this type of cooker is reduced by the use of a narrow or short length of piping which is quite inadequate to produce the amount of draught required.

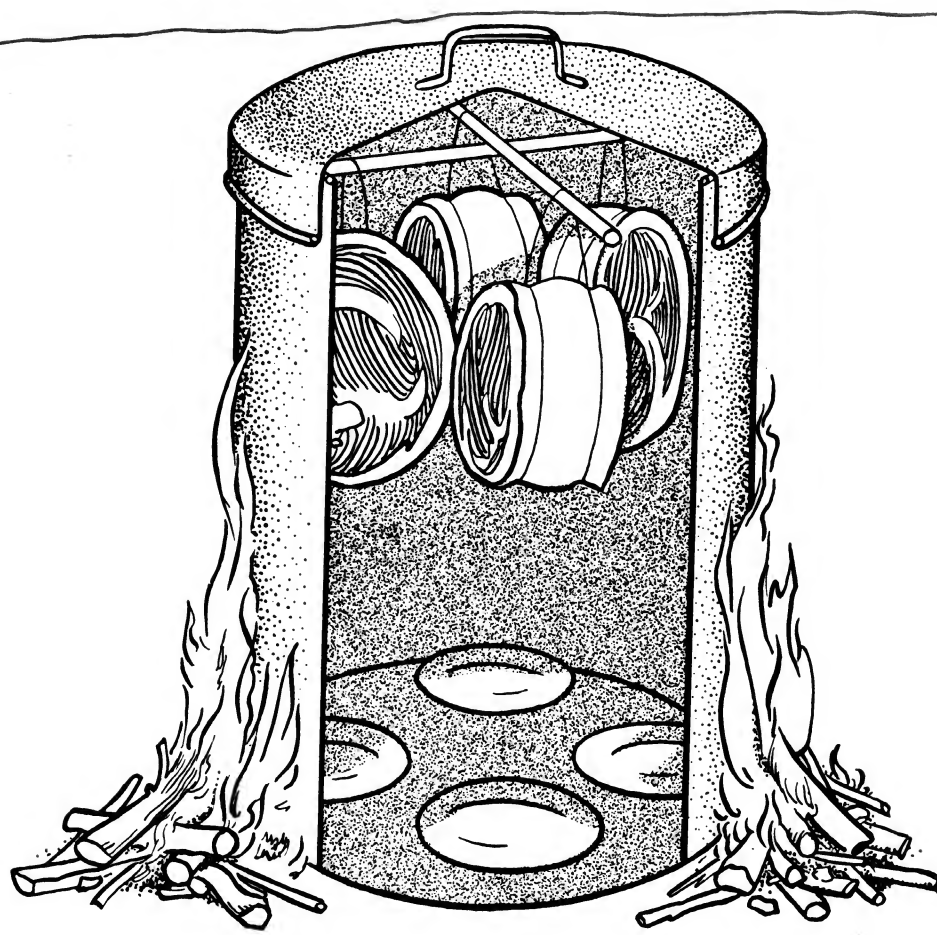


Fig. 71 "ALDERSHOT OVEN"

The amount of residual heat may be roughly estimated by placing the hand in the oven. If the heat is tolerable for five seconds the temperature is about 500°F., a period of 15 seconds indicates about 250°F.

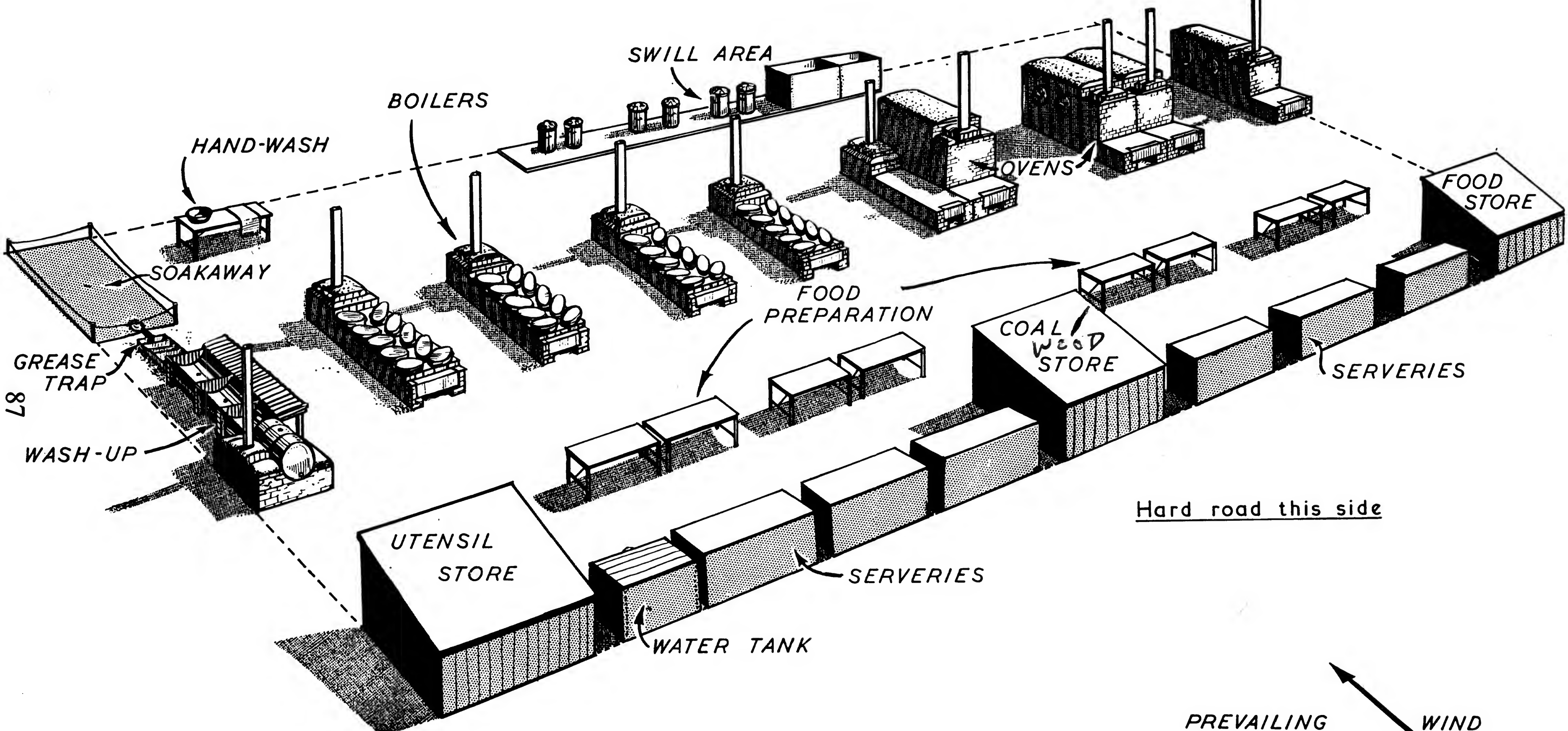

SWILL AREA
BOILERS
HAND-WASH
SOAKAWAY
GREASE TRAP
WASH-UP
OVENS
FOOD STORE
FOOD PREPARATION
COAL WOOD STORE
SERVERIES
SERVERIES
UTENSIL STORE
WATER TANK
Hard road this side
PREVAILING WIND

Fig. 117

Infant feeding

348 The Ministers hold a limited reserve stock of equipment for use at emergency meals centres where shortages are likely to occur under emergency conditions.

Sterilising bottles and teats

349 It is important that the cleaning and sterilising of bottles and teats should be carried out with great care, and the following method should be adopted :

(a) Wash each bottle thoroughly with cold water and salt (if available), using the bottle brush.
Note : Any unwanted milk left in the bottles should be emptied into a jug and may be used for adult feeding if it is first boiled.

(b) Wash each teat thoroughly. Turn inside-out and rub the inside with salt. Rinse in cold water.

(c) Put the teats in a piece of clean butter muslin or similar suitable cotton material and tie up loosely.

(d) Immerse the bottles in cold water in a Soyer boiler or other suitable vessel. Place the bag of teats, bottle brush, mixing spoon and mixing jug in the same boiler. Bring the water to the boil and boil for ten minutes.

(e) Lift the bottles out of the water and turn them upside down to drain. Using tongs, remove the mixing jug and spoon from the boiler.

(f) It is important that only the bottoms of the bottles should be handled ; the sterilising process would be facilitated, and unnecessary handling avoided, if the bottles could be packed and handled in a wire basket or other similar container.

Preparation of feeds

350 After the bottles have been sterilised and are draining, the preparation of the feeds should proceed. National dried milk, evaporated milk or fresh cows' milk are all suitable as a basis for infant feeds. Condensed skimmed milk and sweetened condensed milk whether full cream or skimmed should only be used if the other types are not available. The proportions required to make approximately one pint of feed (or three 6 oz. feeds) from different types of milk are :

	Milk	*Boiling Water*	*Sugar*
National dried	4 heaped tablespoons	20 fluid oz.	6 level teaspoons
Evaporated	5½ fluid oz.	15 fluid oz.	6 level teaspoons
Fresh (boiled)	14 fluid oz.	7 fluid oz.	6 level teaspoons

(Note : 20 fluid oz. = 1 pint)

(a) *Wash and scrub the hands and nails thoroughly with soap and water.*

(b) Measure the required amount of milk into the mixing jug.

(c) Gradually add the appropriate amount of boiling water. When dried milk is used, first mix to a lump-free paste with a little of the boiled water (which should still be too warm to drink), then add the remainder of the measured boiled water, stirring all the time. Add the sugar.

Menu for next 24 hours

1st Meal	Bread or Biscuits Margarine Jam Tea
2nd Meal	Meat Stew (Recipe in paragraph 357) Mashed Potatoes Bread or Biscuits (2 portions) Tea
3rd Meal	Soup Bread or Biscuits Margarine Jam

(See Table of quantities—paragraph 359).

353 If a wider range of foodstuffs becomes available greater variety can be introduced into the menus. The following table offers broad suggestions for seven alternative menus for one day's feeding using dried, canned and fresh foods. Emergency meals centres should try to budget their menus in advance for a number of days.

	Breakfast	Dinner	Supper
1	Porridge Bread or Biscuits Margarine Jam, Marmalade or Syrup Tea	Shepherds Pie Cabbage, Roast Potatoes —— Boiled Fruit Pudding —— Bread —— Tea or Coffee	Tomato Soup Bread Margarine Tea or Cocoa
2	Porridge Bread or Biscuits Margarine Jam, Marmalade or Syrup Tea	Meat and Vegetable Stew Cabbage, Boiled Potatoes —— Prunes and Custard —— Bread —— Tea or Coffee	Baked Beans Bread Margarine Tea or Cocoa
3	Porridge Bread or Biscuits Margarine Jam, Marmalade or Syrup Tea	Fried Fish Peas, Roast Potatoes —— Jam Tart —— Bread —— Tea or Coffee	Scotch Broth Bread Margarine Tea or Cocoa

356 Soup ($\frac{1}{2}$ pint per person)

	Per 100	Per 500
Soup powder	6 lb. 4 oz.	31 lb. 4 oz.
Water	$6\frac{1}{4}$ gal.	$31\frac{1}{4}$ gal.

(a) Mix the soup powder to a smooth paste with some of the cold water.
(b) Bring the remainder of the water to the boil, add the soup paste, stir well until boiling.
(c) Boil for 5 minutes.

357 Stew. *Using canned meat and fresh vegetables to give $\frac{1}{2}$ pint portions*

Commodity	Amount required per 100	Amount required per 500
Canned meat	10 × 20 oz. cans	50 × 20 oz. cans
Carrots	25 lb.	125 lb.
Turnips	12 lb.	60 lb.
Potatoes	18 lb.	90 lb.
Onions or leeks	3 lb.	15 lb.

If only canned vegetables are available the following quantities can be substituted for those in the preceding table :

Commodity	Amount required per 100	Amount required per 500
Canned carrots	20 × 15 oz. cans	100 × 15 oz. cans
Canned baked beans	25 × 16 oz. cans	125 × 16 oz. cans
or		
Canned peas	14 × 28 oz. cans	70 × 28 oz. cans
	or	*or*
	25 × 16 oz. cans	125 × 16 oz. cans
Dehydrated onion powder	8 oz.	2 lb. 8 oz.

1. Prepare fresh vegetables.
2. Place these in the Soyer boiler with sufficient water to cover, and seasoning to taste.
3. Cook 2-3 hours, then add canned meat, bring back to boiling point and serve.
4. If canned vegetables are used, empty contents of cans into Soyer boiler and bring to boiling point, simmer for 10-20 minutes.

358 The following sample recipes are suitable for some of the more substantial meals suggested in paragraph 353.

	Commodity	Size of Serving	Amount required per 100	Amount required per 500
Lentil Soup	Lentils	$\frac{1}{2}$ pint	10 lb.	50 lb.
	Water		5 gal.	25 gal.
	Carrots		5 lb.	25 lb.
	Onions		2 lb.	10 lb.
	Potatoes		10 lb.	50 lb.
	Salt		5 oz.	1 lb. 8 oz.
	Pepper		$\frac{1}{2}$ oz.	2 oz.

1. Soak lentils overnight.
2. Place lentils, diced vegetables, seasoning and water in the boiler.
3. Simmer gently until vegetables are cooked, stirring frequently to prevent burning. The cooking time is about $1\frac{1}{2}$ hours.

	Commodity	Size of Serving	Amount required per 100	Amount required per 500
Scotch Broth	Neck of Mutton	½ pint	8 lb.	40 lb.
	Water		6 gal.	30 gal.
	Carrots		8 lb.	40 lb.
	Turnips		5 lb.	25 lb.
	Onions		4 lb.	20 lb.
	Pearl Barley		3 lb.	15 lb.
	Dried Peas		3 lb.	15 lb.
	Salt		6 oz.	1 lb. 12 oz.
	Pepper		½ oz.	2 oz.
	Cabbage		3 lb.	15 lb.

1. Soak barley and peas overnight.
2. Cut meat into small pieces, dice carrots, onions, and turnips, shred cabbage.
3. Cook meat, vegetables, barley and seasoning with water in boiler approx. 2 hours.
4. 10 minutes before serving add shredded cabbage.

	Commodity	Size of Serving	Amount required per 100	Amount required per 500
Shepherds Pie	Minced Beef	½ pint	15 lb.	75 lb.
	Onions		2 lb. 8 oz.	12 lb. 8 oz.
	Carrots		5 lb.	25 lb.
	Fat		1 lb. 4 oz.	6 lb. 4 oz.
	Flour		1 lb.	5 lb.
	Stock or Water		5 pints	3 gal.
	Salt		2 oz.	10 oz.
	Pepper		2 tsp.	½ oz.
	—Potatoes		30 lb.	150 lb.
	—Salt		4 oz.	1 lb. 4 oz.

1. Mince vegetables, fry with minced beef in fat until golden brown.
2. Add flour, stock and seasoning, stir well, bring to simmering point, place in baking tins.
3. Cook and mash potatoes, add salt, place on top of mixture. Bake in hot oven 45-60 mins.

	Commodity	Size of Serving	Amount required per 100	Amount required per 500
Irish Stew	Mutton	½ pint	22 lb.	110 lb.
	Onions		5 lb.	25 lb.
	Potatoes		35 lb.	175 lb.
	Turnips		5 lb.	25 lb.
	Water		4½ gal.	22½ gal.
	Salt		6 oz.	1 lb. 12 oz.
	Pepper		½ oz.	2 oz.

1. Cut up meat.
2. Slice onion and turnip. Bring water to the boil with meat, sliced onion and seasoning.
3. Simmer 1 hour, add sliced turnip and whole potatoes, simmer further 2 hours.

CHAPTER X

Emergency Feeding in Fall-out Conditions

General

364 The foregoing chapters of this handbook have been written on the assumption that emergency feeding centres would be set up in areas free of fall-out ; but it may be found necessary to improvise cooking arrangements or to set up emergency meals centres in areas which may have had some fall-out.

365 This fall-out will consist of dust particles, made radioactive and sucked up by a nuclear explosion, carried in the air over a very wide area, drifting slowly to earth. Hours or days might pass before the dust fell, according to the distance from the explosion and the wind conditions in the upper and lower layers of air. It could be carried many miles from the centre of an attack. This dust would be indistinguishable from ordinary dust, but it would be radioactive, and would give off various forms of radiation which could be harmful and even lethal to humans and animals. This radiation, which decays over a period, can, however, be measured by radiac instruments, and its degree of harmfulness can be assessed.

366 Advice will be given to the inhabitants of areas affected as to the degree of fall-out, whether and when they may emerge from shelter, and as to the time which may, if absolutely necessary, be spent in the open. All inhabitants of such areas must, if they value their lives, observe the advice given to them.

Centres under cover

367 If it were found necessary soon after an attack to set up an emergency meals centre in a fall-out area it should be set up under good cover. Care would have to be taken to see that adequate vents were provided for smoke and fumes to escape, and emergency feeding supervisors, leaders and teams would have to do whatever was possible in the circumstances.

Outdoor centres

368 It will be clear from the above that emergency feeding in the open could not be carried out until the Warden Section had announced that (1) all fall-out was down in the area, and (2) that the radiation from the fall-out had decayed to a point where it was possible to remain outdoors for a limited number of hours each day. Given these conditions an outdoor feeding centre could be set up. Hard standing should be selected, and the site would have to be hosed down in order to remove radioactive dust as far as possible. Manufactured equipment, the materials to be used for building improvised cookers, and all utensils would first have to be washed or hosed down to remove any dust. Any washing cloths

used should then be thoroughly rinsed. The washing and rinsing water should be discharged down a drain. Pug should not be made from the top skin of soil, but from the lower soil. If water supplies permit, it would be better to use only " clean " water to make the pug; but as the quantity used would be small there should be only a negligible amount of radioactivity if water which had been exposed to fall-out were used. Emergency feeding teams would have to observe strictly any advice given as to the length of time which they could spend in the open—even if to do so would involve considerable delay in the erection and use of an outdoor kitchen. If possible, a dosimeter should be carried by one member of each feeding team, and the readings upon that instrument should be taken as applicable to the whole team. This means that the team would have to work as a unit throughout, undergoing the same exposure. Any member of a team who undertook exposure longer than was deemed safe by the reading on the dosimeter would run a serious risk. It would be the duty of team leaders and centre supervisors to prevent this, as far as possible, by the careful organisation of shifts in relation to the exposure rate.

Precautions

369 It would be necessary to protect food, water, and other essentials from fall-out of radioactive dust, which, like ordinary dust, would settle on anything. There are only two ways in which to reduce or remove the danger from this dust. The first is, in any period of warning before an attack, to place food, water and other essentials under good cover. The second, after an attack, is to remove the radioactive dust or material contaminated with it and put it where the radioactivity can decay harmlessly. A simple way to remove radioactive dust is to wash down with water and for the water to discharge down a drain, but see also para. 372(i) below for treatment of unopened cans or other containers.

370 *It is dangerous to eat any food, or drink any liquid, upon which particles of dust may have settled.* If fall-out dust has not actually settled upon the food or water (but, for example, only upon the containers) radiation from that dust will not make the food or water dangerous to consume.

371 It would therefore be important to ensure that food, water, cooking utensils, and, if possible, fuel supplies, are kept under good cover and properly protected against any fall-out dust which might penetrate into the shelter or store. Crockery and cutlery, towels, dishcloths and kitchen utensils, and the like, should be kept covered when not in use. The lids of fuel storage bins should be kept closed and any fuel not in bins should be covered.

372 The following points should be noted :

(i) Food in unopened cans or other airtight containers would be safe from contamination ; containers upon which fall-out dust may have settled should be washed and then wiped off with a damp cloth. The washing cloths should be thoroughly rinsed after use, and the rinsing water discharged down a drain. Care should be taken that no fall-out dust from the lids enters the foods as they are opened. All other food would have to be packed or wrapped as far as practicable and the outer package or wrapping

carefully wiped down and removed before use. Unwrapped or unpackaged food should not be used if there is any suspicion of contamination by radioactive dust.

(ii) If garden or farm produce is collected from an area which may have had fall-out, strict precautions should be taken. The essential thing to do is to remove all fall-out dust because its effects are not destroyed by boiling or cooking.

(iii) *Potatoes and Roots.* It would be safe to use fully grown potatoes and root crops dug from the soil or taken from clamp, provided they were well washed to remove all soil particles and also peeled.

Peas and Beans. The pods of peas and beans might be contaminated. Only the peas and beans inside would be safe to eat.

Green Vegetables. It is better not to eat green vegetables which might have been subject to fall-out. But if it became necessary to take the risk, only those plants with solid hearts should be chosen, such as cabbages, sprouts and lettuces. Several layers of the outer leaves would have to be removed, and the heart washed thoroughly before cooking. The discarded leaves should not be kept indoors. Loose-hearted plants would not be fit to use.

Hard fruits (apples, pears, etc.) should be well washed and peeled before use.

Soft fruits which may have been subject to fall-out should not be used as it is not certain that all fall-out which might have settled on them would be removed by washing.

Meat. In areas where the level of radioactivity made it likely that livestock would suffer from radiation sickness, they would have to be slaughtered before they actually sickened. The bones and offal would not be safe to use for human consumption, and would have to be removed before the flesh was cooked. The flesh might be usable after thorough washing and cooking but expert advice should be sought wherever possible.

Fish. It is possible that fish may be caught which has lived for a time in contaminated water, in which case the fish itself could be contaminated to a certain degree and would have to be checked before consumption. In view, however, of the dilution effect of water reducing the concentration of radioactive materials, the degree of contamination is not expected to be serious. It is essential to ensure that in transport the fish is not exposed to contamination, but if that does occur, it should be possible to remove by normal washing procedures.

Milk. There would be great risk in consuming milk upon which fall-out dust had fallen, or which came from cows which had eaten food or grazed on land contaminated by fall-out. Milk should not be used unless the Local Food Officer has stated that it is safe for consumption.

Eggs. The risk of dangerous contamination in eggs is small and they could be used if urgently needed for food. The main risk lies in the shell which should be washed and then discarded before the white and the yolk are cooked. Do not serve boiled eggs.

(iv) *Water* in the mains may be contaminated by fall-out and should not be drunk or used for cooking unless it has been pronounced safe by the responsible authority. This applies even in an area which is itself free from fall-out since the water may have come from a contaminated source some distance away. Advice should be sought from the local water undertakers. If the mains are disrupted or the supply contaminated the local water undertakers may be able to cart water to the site. If, in an extreme emergency, the advice of the local water undertakers cannot be obtained and it is vitally necessary to consider the use of local sources of water supply not likely to be affected by fall-out (e.g. covered wells), the advice of the Public Health Department should be obtained before the water is used. ***Boiling will not make water fit to drink once it has been contaminated by fall-out.***

N.B. When washing equipment and produce, which may have been subject to fall-out, protective clothing and gloves (preferably rubber) should be worn in order to keep contamination away from the skin. If such gloves are not available, hands, and particularly nails, should afterwards be scrubbed. Discarded tins, packaging, leaves, pods, etc., which may have been in contact with fall-out dust should be kept apart in a strong covered receptacle and burnt or buried as soon as possible well away from the kitchen site.

Radiation sickness

373 One result of exposure to radiation from fall-out dust is radiation sickness, which may appear in some of the people in or from fall-out areas. The human body can absorb a limited amount of radiation, but there is a point where the amount absorbed would start to destroy living tissue and interfere with the formation of new blood. The result is serious illness and, with heavier doses, death.

374 Persons affected may feel little wrong with themselves at the time, apart possibly from a sensation of shock. Symptoms do not show themselves until later—how soon depending on the strength of the dose. If it were heavy, the first symptoms—nausea and severe shock—would come within a few hours. These would be followed, in the first day or two, by vomiting, diarrhoea and fever, with tiredness and depression, but little pain. In less serious cases symptoms would appear only after several days, or even two or three weeks. Other symptoms are loss of appetite, loss of hair (which grows again as the patient recovers), internal bleeding and bleeding of the mouth and gums.

375 Radiation sickness is not infectious, but people suffering from it have less than normal resistance to infection. Careful first-aid would therefore have to be given to even the simplest cuts or wounds. The mouth, throat and nose would need to be kept scrupulously clean. If possible, people affected would have to be kept warm and allowed complete physical and mental rest. Rest, good food and good nursing are the best treatment.

376 Members of emergency feeding teams must keep a look-out for radiation sickness conditions appearing in themselves, their colleagues, or in the people passing through their centre. There is the risk that the symptoms may be confused with those of food poisoning (see Chapter VII) ; and medical advice should be sought upon any suspected case of either.

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WAR-TIME COOKERY

To Save Fuel and Food Value

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1. Keep a vegetable stock-pot with the water from celery, leeks, onions, carrots, potatoes, greens, and other vegetables.
   Never throw these liquids down the sink; they contain valuable minerals and vitamins, and partly help to make up deficiency in rationed foods.
2. Use the liquid from boiled vegetables to dilute tinned soups.
3. When serving soup and vegetables at the same meal, cook the vegetables **in** the soup.
4. Steam root vegetables.
5. Cook potatoes in their jackets.
6. Save all fat from cooking meat; refine it and use it for other cooking purposes.
7. Cook meals as far as possible with one "unit" of heat, e.g. in one large steamer on a low fire or single gas-ring you may cook: a meat roll, steamed jacket potatoes, boiled or steamed suet pudding; or in one oven you may cook: baked meat, casserole of mixed vegetables, fruit pie or pastry, scones.

Introduce into the menu as often as possible the following foods:

Meat.—Tripe, cow-heel, ox-tail, liver, kidney, hearts, tongues, rabbits, calves' and sheep's heads, fresh bones.

Vegetable Marrow and Tomato

Peel marrow—remove seeds—cut in slices—parboil then sauté in hot fat until tender—peel and slice a few tomatoes—arrange on baking dish alternately with sliced marrow, and when the dish is full, season, and, if liked, sprinkle the top with grated cheese or browned crumbs. Baste with gravy, and bake in a hot oven for a few minutes.

Potato Short Bread

3 ozs. margarine
2 ozs. rice flour
A pinch of salt
A little almond flavouring
4 ozs. warm mashed potato
3 ozs. flour
2 ozs. sugar

Cream fat and sugar, then add mashed potato, beat well, then rice flour, salt and flavouring. Take out spoon and with hands lightly press the flour (containing a little baking powder) into the mixture—roll out and bake.

Potato Cheese

Line patty-tins with pastry.
Mixture:

2 ozs. fat creamed with
 2 ozs. sugar
2 dried eggs or 1 fresh egg
½ lb. potato pulp
½ pint milk
Almond flavouring
1 oz. cornflour
2 ozs. apples, minced and fried slightly in a little hot fat

Make milk and cornflour into a sauce, work in the eggs, creamed fat and sugar and potato. Put a little jam in bottom of pastry, put mixture on top. If liked, apples may be peeled, cored, cut into sections and placed overlapping on top. Bake about twenty minutes.

Potato Suet Paste

½ lb. flour—put into a bowl
4 ozs. chopped suet
¾ teaspoonful baking powder
½ teaspoonful salt

Mix well, add ½ lb. warm mashed potato, mix lightly. When thoroughly mixed squeeze together to form a

paste, probably without using any moisture. May be used for potato pie.

Potato Pie

Mixture: Fry 1 oz. onion, fat, and a sprinkle of flour together, add ½ pint of water or stock, 3 ozs. cooked meat, trimmings from bones, etc., ¼ teaspoonful mixed herbs, put into pan and cook together for a few minutes, then add ½ lb. potato cut up (cooked or uncooked), a little more water if necessary, season nicely.

Roll out half the paste, cut in two strips, line sides of dish—none at bottom—trim and decorate edges of pastry, put mixture in dish, decorate top with slices of partially cooked potato overlapping, put a little dripping on top. Bake about thirty minutes.

Potato Macaroni Pudding

In a bowl put:

½ lb. mashed potatoes
2 ozs. nuts, chopped
1 oz. fried onion
A pinch of mixed herbs, pepper, salt and nutmeg
1 oz. cooked chopped macaroni
A little chopped parsley
2 ozs. suet
1 egg
4 ozs. flour, containing ½ teaspoonful baking powder

Mix very well together, do not make too moist, put into greased basin, steam for one-and-a-half to two hours. Serve with brown gravy sauce.

Onion and Cheese Pudding

1 large sliced onion
1 oz. fat
1 oz. flour

Fry onion. Move to one side, and fry flour. Add 1½ pints water, seasoning, and simmer till onion is tender. Sprinkle strips of bread with grated cheese. Place in layers in greased pie-dish, pour the soup over, and bake until brown.

Haricot Bean Stew

1 lb. cooked beans	1 oz. chopped onion

Put 1 oz. fat in saucepan and fry onion, then put beans on top and a little chopped parsley. Cover with stock or water, add pepper and salt and 1 teaspoonful vinegar, and simmer until tender, thicken, boil and serve. An excellent dish made with beans, peas, lentils, or macaroni.

Vegetable Stew

1 lb. carrots	¼ lb. celery
1 lb. turnips	1 lb. cabbage
1 lb. onions	4 ozs. fat
½ oz. salt	1 tablespoonful Worcester sauce
About 1½ to 2 pints water	

Prepare vegetables and put into pan with hot fat and salt. Mix all together, cover with lid, stirring carefully from time to time until the vegetables are nearly tender, then leave alone until lightly baked at bottom. Then add 1 tablespoonful Worcester sauce, a little pepper, and sufficient water to make gravy about 1½ to 2 pints. Stew for fifteen minutes longer, then serve.

Oatmeal Sausage

Oatmeal alone, or oatmeal and meat	½ pint stock

Put ½ oz. fat into saucepan, and fry in it 1 oz. onion, then put with it 2 ozs. shredded suet, ½ pint stock, 4 ozs. oatmeal (2 ozs. coarse and 2 ozs. fine), add a pinch of mixed herbs, pepper and salt. Mix very well with wooden spoon, and boil until like a very thick porridge (about ten or fifteen minutes), add 1 tablespoonful of Worcester sauce, put mixture on plate to cool slightly. Cut into six, roll into sausage shapes, coat with batter and fry. Fry in deep fat if possible, and serve with mashed potatoes.

Cabbage and Rice

One young cabbage—remove stalk, shred finely (about 6 ozs.); 1 oz. onion—fry in 1 oz. fat, then add the cabbage, ½ gill of water, a little salt only, as salts are retained in the vegetable.

Bring to boil on a slow fire. When cabbage is half done, put 1 oz. uncooked rice and ¾ gill of water to cover rice, and cook for another twenty minutes slowly. Then dish.

Vegetable Pie with Mashed Potatoes

Put some mixed cooked vegetables into a dish and season. Make a brown gravy with ½ oz. of fat, small ½ oz. flour, ¼ pint vegetable stock, seasoning, and a very little grated nutmeg. Pour this over the vegetables. Put a thick crust of mashed potatoes on top, sprinkled with chopped cheese, and bake.

Pea Soup

(Quick method)

1 lb. leeks, onions and celery mixed
½ pint cooked peas
1 oz. fat

Fry together, put in ½ pint of cooked peas, minced, and 1 quart of water. Boil until tender, thicken with rice or potato flour, sprinkle a little chopped mint on top.

Onion and Potato Soup

1 large potato
1 large onion
½ oz. margarine

Chop vegetables small and sauté in fat for ten minutes. Add three teacups of water (or liquid from macaroni, potatoes, or tripe) and cook till vegetables are pulped. Sieve, add 1 teacup of milk, and bind with ½ teaspoonful cornflour. Season, sprinkle with chopped parsley, and serve with croûtons of brown bread fried in dripping.

Butter Bean Soup

1 lb. butter beans
1 onion
1 oz. margarine
Slice of bacon
1 pint milk
Seasoning
Chopped parsley

Soak the beans overnight and squeeze from their skins. Well cover with cold water, bring to boil and cook until quite soft, crushing with a wooden spoon.

Cut up the bacon and fry with the sliced onion in the margarine. Add the bean purée, and simmer for a few minutes. Add the milk, bring to the boil, and serve sprinkled with chopped parsley.

Tomato Soup

1 lb. tomatoes
1 small onion
1 small sour apple
1 pint milk and water
1 beef cube or teaspoonful of meat essence
1 tablespoonful sugar
Seasoning
1 oz. margarine
1 teaspoonful cornflour

Shred the onion and apple and fry for five minutes in the margarine. Add the tomatoes cut up, and the sugar and seasoning. Sauté ten minutes. Dissolve the meat essence in the milk and water and add to tomatoes. Simmer for ten minutes, sieve, thicken with cornflour and colour with a little carmine.

Puddings and Sweet Dishes

Mixed Fruit Pudding

½ lb. soaked bread or crusts
1 oz. flour
4 ozs. chopped suet
2 ozs. sugar
1 beaten egg
6 ozs. mixed fruit, raisins, currants, chopped figs and dates
¼ teaspoonful mixed spice
¼ pint milk

Mix all ingredients very thoroughly and steam in a greased basin for two hours. If made a little moister, the mixture may be turned into a greased pie-dish and baked for three-quarters of an hour.

Date and Apple Pasty

Make ½ lb. plain pastry and roll out to ¼ inch thick. Line a flat tin, place on it a thick layer of apple and stoned dates finely chopped. Cover with a thin layer of pastry, pressing the edges well down. Bake in a hot oven for a quarter of an hour to twenty minutes.

Syrup Tart

Make ½ lb. plain pastry. Line plates with pastry a good ¼ inch thick, leaving some paste over for decorating. Fill the centre with golden syrup and sprinkle thickly with soft white crumbs. Decorate with twisted strips of paste and bake till a pale golden brown.

Date and Walnut Loaf

½ lb. dates
1 teaspoonful bicarbonate soda
⅓ pint boiling water
½ lb. flour
2 ozs. margarine
3 ozs. sugar
1 level teaspoonful baking powder
1-2 ozs. chopped walnuts
1 egg
Salt

Stone the dates and mince or chop them small. Sprinkle with the bicarbonate of soda, pour on the boiling water, and leave to soak. Rub fat in flour, add all other dry ingredients. Add date mixture when cool, and then beaten egg. Put into two greased ½-lb. bread-tins, and bake for one-and-a-half hours in slow oven.

Apple Pancakes

Stew 1 lb. apples to a soft pulp without sugar. Beat two tablespoonfuls of syrup into the apple. Make batter pancakes in the ordinary way, and serve with a large spoonful of the apple mixture folded into the centre of each.

PUDDINGS & SWEETS

Children should be encouraged to eat their first course of meat, fish or cheese, etc., potatoes and vegetables or salad before they are allowed the sweet course. Puddings and sweets are only tit-bits for filling up odd corners and must not be regarded as the main part of a meal.

Puddings may be rather a problem these days because fat and sugar are rationed and not much of either is left after we have buttered our bread and sugared our tea. However, with care you will probably be able to spare sufficient of these ingredients to make some of the wartime recipes given in this leaflet. Various flavourings can be added to the "basic" recipes to produce a number of different puddings. All recipes are enough for 4 people.

Steamed and Boiled Puddings

Basic Pudding using Mashed Potato

- 8 oz. flour
- 2 level teaspoons baking powder
- Pinch of salt
- 2½ oz. fat
- 2 oz. sugar
- 2½ oz. mashed potato
- Flavouring (any available flavouring may be used)
- Household milk to mix

Mix flour, baking powder and salt. Rub in fat, add sugar, potato, flavouring and sufficient milk to mix. Turn into a greased basin and steam for 1 hour.

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ALL RECIPES ENOUGH FOR FOUR PEOPLE

Basic Recipe using Raw Grated Potato to replace half the fat

1 oz. fat	2 level teaspoons baking powder
8 oz. flour	1 oz. grated raw potato
Pinch of salt	Water to mix
2 oz. sugar	Flavouring or fruit

Rub the fat into the flour, add salt, sugar and baking powder. Stir in the grated raw potato and mix to a moist consistency with water or milk, add fruit or flavouring. Place in a greased basin and steam for 1½—2 hours.

Note.—By omitting the sugar and flavouring, this mixture can be used as a suet crust with a variety of fruit or meat fillings.

Suitable Flavourings for use with basic Recipes

- 1. Syrup and ginger
- 2. Leave the pudding mixture plain and put jam or syrup or marmalade at the bottom of the basin
- 3. Add 2—4 oz. dried fruit
- 4. 1 oz. cocoa and a few drops of vanilla essence and a little more sugar
- 5. Serve with a sweet sauce, flavoured with one of the above
- 6. Black coffee or coffee essence

Prune Sponge

1 oz. fat	Salt
8 oz. flour	1 tablespoon syrup
½ teaspoon mixed spice	Water or milk to mix
½ teaspoon nutmeg	8—12 prunes
½ level teaspoon bicarbonate of soda	

Rub the fat into the dry ingredients and mix to a soft consistency with syrup and milk or water. Place the soaked stoned prunes in the bottom of a greased basin and pile the pudding mixture on top. Cover with a greased paper and steam for 1½—2 hours.

Use the prune juice thickened with cornflour or custard powder as a sauce (1 level tablespoon to ½ pint of liquid).

Jack Horner Pudding

6 oz. flour	Water to mix
2 level teaspoons baking powder	1 lb. fresh fruit or 6 oz. dried apricots or apple soaked overnight
½ teaspoon salt	Sugar to sweeten or saccharine
1½ oz. suet or fat	
1½ oz. grated raw potato	

Mix flour, baking powder and salt. Rub in fat or add suet. Add potato. Mix to a stiff dough with water. Roll out ½ in. thick and the size of a saucepan top. Put fruit into pan with the sugar and a little water if fresh fruit is used or cover with water if dried fruit is used. When boiling put in the pastry round and cook about 30—45 minutes, dish up with fruit piled on pastry.

BAKED PUDDINGS

Chocolate Pin Wheels

Pastry—	*Chocolate Mixture—*
8 oz. flour	2 oz. margarine
1 oz. margarine	4 level tablespoons sugar
4 oz. cooked mashed potato	2 ,, dessertspoons cocoa
2 level teaspoons baking powder	½ teaspoon vanilla essence
Pinch of salt	
Milk or water to mix	

Make pastry and roll out to an oblong shape. Cream margarine and sugar, add cocoa and vanilla essence. Spread mixture on pastry and roll up as for jam roll. Cut into ¼ in. slices. Lay slices flat in a baking tin. Bake in a moderate oven for 20—30 minutes.

Two Sweet Fillings for Tarts

Chocolate Filling

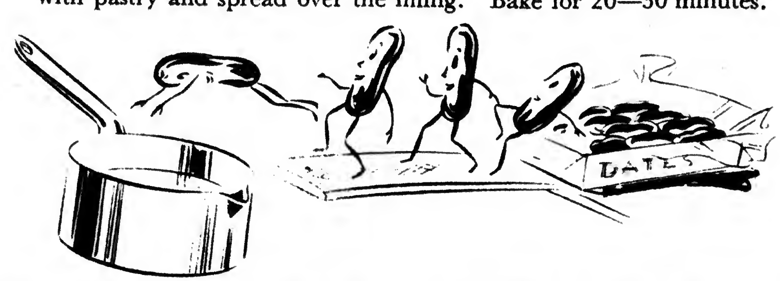
3 saccharine tablets or 1 tablespoon sugar	3 oz. breadcrumbs
½ teacup of milk	4 level teaspoons cocoa
1 reconstituted dried egg	A few drops of vanilla

Dissolve saccharine or sugar in the milk. Beat the reconstituted egg with the sweetened milk. Pour over the breadcrumbs mixed with the cocoa. Beat well in a pan over the heat for a minute or two. Add vanilla. Cool and pour into prepared pastry lining a deep plate. Cover with a pastry lid and bake in a moderate oven for 30 minutes.

Date Filling

4 oz. dates	4 level teaspoons custard powder
4 tablespoons water	1 teaspoon lemon essence

Wash and stone the dates and stew in the water until soft. Add the blended custard powder and lemon essence. Bring to the boil and cook for 2—3 minutes stirring the whole time. Press the dates on the side of the pan to help break them down. Line a tin with pastry and spread over the filling. Bake for 20—30 minutes.



MILK PUDDINGS

Junket with Dried Milk

6 level tablespoons dried milk
¾ pint warm water
2 level tablespoons sugar
Little vanilla or other flavouring liked
Rennet 1½ times the quantity given on the bottle

Reconstitute the milk in ¾ pint warm, *not hot*, water. Put into a double pan or basin over a pan of boiling water, add sugar and any flavouring liked, make hot to blood heat, pour into a glass dish and put in the rennet stirring quickly and gently. Leave till set.

To make Chocolate Junket. When the milk is the right heat, blend 1 tablespoon cocoa with a little milk, add to the warm milk and stir until dissolved. Pour into a glass dish and add the rennet.

American Bread Pudding

3—4 oz. bread cut in small cubes (including crusts)
1 pint milk
½ oz. margarine
1 tablespoon sugar
1 egg reconstituted
Pinch of salt
1 teaspoon vanilla or
¼ teaspoon spice

Heat the milk and margarine and pour on the bread. Set aside to cool. Add remaining ingredients, mix well and bake until set in a moderate oven.

Variations. Spread top with jam before serving; or add little dried fruit before baking; or add 2 tablespoons cocoa and an extra tablespoon sugar.

COLD PUDDINGS

Swiss Pudding

8 level tablespoons rolled oats
3—4 tablespoons milk
1 tablespoon dried fruit or
3 tablespoons fresh fruit
Sugar to taste

Soak the oats in barely enough water to cover them. Leave overnight. Add milk, fruit, and sugar to taste. Beat well and serve cold.

Chocolate Oatmeal Pudding

4 oz. oatmeal
1 pint milk or milk and water
1 dessertspoon cocoa
1 tablespoon sugar
Vanilla flavouring

Soak the oatmeal overnight in half the milk. Add the rest of the milk and cook slowly until soft. Add the cocoa and sugar and cook for 15—20 minutes. Add the vanilla, beat well. Pour into a damped mould and leave until set. Turn out and serve cold.

Apple Fool

½ lb. cooked mashed potato
1 lb. grated raw apple
1 tablespoon powdered milk
2 tablespoons sugar
½ teaspoon lemon substitute
A few drops of cochineal

Mix all ingredients together and beat well till creamy. Serve in individual glasses.

N.B.—The cochineal may be omitted but in this case the fool turns brown.

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Medical Manual of Defence Against Chemical Agents

(Ministry of Defence publication: J.S.P. 312. This document is a revision of the 1939 "Medical Manual of Chemical Warfare", which was a revision of the 1926 "Manual of the Medical Aspects of Chemical Warfare". It also replaces the Air Raid Precautions 1935 Handbooks 1-3, "Personal Protection Against Gas", "First Aid Nursing for Gas Casualties", "Medical Treatment of Gas Casualties"

(EXTRACTS)

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SECTION I—GENERAL INTRODUCTION

CHAPTER I

GENERAL DESCRIPTION OF CHEMICAL AGENTS

1. The term "Chemical Agent" is applied to any chemical compound which, when suitably disseminated, produces incapacitating, damaging or lethal effects in man, animals, plants or materials.

2. The medical services must, however, also consider the toxic effects of various poisonous substances which may be encountered incidentally under Service conditions.

Historical

3. Chemical operations in the modern sense were first waged by Germany in the 1914–18 War. Chlorine gas was released from large cylinders in a favourable wind. The Allies were taken by surprise and, as the men had no respirators, casualties were heavy. Means of protection had to be improvised at once. The first official respirator (a cotton pad soaked in hyposulphite of soda, glycerine and sodium carbonate) was issued in May 1915, and after that date defence, on the whole, kept ahead of attack—so much so, that the use of phosgene gas by the Germans in December 1915 found the Allies relatively well protected against its effects.

In the hope of overcoming this protection the Germans tried arsenical irritant smokes which they hoped would penetrate the box respirator then used by the Allies. This proved a comparative failure. The use of mustard agent against the Allies was, however, highly successful.

4. Chemical operations were not used in World War II and various conjectures have been made as to the reason for this. It is known that the Germans had chemical agents available, and at the end of the war British and American forces discovered stocks of newer agents called "Nerve Gases". These were found to be effective in extremely low concentrations. Probably the high standard of training and preparedness of the Services and the fear of retaliation by the Allies were the main reasons why chemical agents were not used.

5. Apart from World War I, there is no record of chemical operations having been used between technically well equipped combatants, but between the wars it was known that mustard agent was used to considerable effect against the unprotected Abyssinian tribesmen and troops. Chemical operations were not used in the Spanish Civil War and, apart from the use of an unspecified chemical agent in the Yemen, they have not been used by participants in the various insurrections that have taken place since World War II.

6. The use of riot control agents ("tear gas") has, however, been extended more recently to harrass guerillas, in particular to flush them from hiding and to render places of concealment such as tunnels untenable.

7. The advent of nuclear weapons, and the fact that chemical operations were not used in World War II, do not exclude the possibility of their being used in a future war. The experiences of World War I indicate that chemical agents are useful strategic and tactical weapons. They can affect both forward and rear areas.

8. During World War I, chemical agents were used only in land weapons and not from aircraft; chemical casualties were mainly due to vapour and were largely confined to troops in the field. In a future war, chemical agents may be dispersed by other methods on to selected targets far removed from the fighting line, such as cities, dockyards and factories. It, therefore, seems probable that the nature and severity of casualties may differ from those recorded in World War I.

General Factors Influencing the Employment and Choice of Chemical Agents

9. The effective use of any chemical agent is dependent on its physical and chemical properties and on meteorological conditions.

10. For tactical purposes chemical agents may be divided into two main categories as follows:

(*a*) *Non-persistent agents* are those which remain in effective concentrations for only a short time. They are released as airborne particles of a solid, droplets of a liquid, or as true gases. They are affected by prevailing weather conditions and are quickly dispersed, so that the locality in which they have been released soon ceases to be dangerous.

(*b*) *Persistent agents* are substances which remain dangerous for some considerable time unless action is taken to destroy or neutralise them. They may be liquid or solid at normal temperatures.

11. The following meteorological factors are likely to influence the use of chemical agents:

(*a*) *Winds:* Strong winds rapidly disperse non-persistent agents in open country, although dangerous concentrations may take longer to clear from woods, dugouts and built up areas.

(*b*) *Temperature:* High temperatures increase the effectiveness of the less volatile persistent agents since high vapour concentrations are given off from them. Low temperatures may freeze persistent agents and will, in any case, increase their persistence. The danger of carrying such agents into a warm building on boots and equipment, whereupon toxic vapour will be given off, should be borne in mind.

(*c*) *Rain:* Heavy rain reduces the effectiveness of chemical agents, but does not make them impossible to use.

(*d*) *Atmospheric stability:* When the air temperature is higher than that of the ground (an inversion), agents in the vapour state will persist for longer periods than when the air temperature is lower than the ground temperature (a positive lapse rate).

Chemical Agents

12. For medical purposes, chemical agents are usually classified according to pharmacological principles, but for general service usage it is desirable to classify these agents according to their overall effects on combat effectiveness. Medical officers in field force units must understand both types of classification in order that they may be able to advise personnel of other arms. Table I shows these methods of classification on a comparative basis.

Table I. Medical and Service Classification of Chemical Agents

Medical Classification	*Equivalent Service Classification*
A. *Agents liable to be met in warfare*	
1. Nerve agents (G and V)	Lethal agents (Nerve)
2. Lung damaging agents (Phosgene and Cl_2)	Lethal agents (Choking)
3. Vesicant agents (sulphur mustard, Lewisite etc)	Damaging agents (Blister)
4. Psychotomimetic agents (LSD, BZ)	Incapacitating agents (Mental)
5. Miscellaneous agents	
(a) Cyanide, CNCl	Lethal agents (Blood)
(b) AsH_3	
6. Herbicides	Anti-plant agents
B. *Agents liable to be met in Riot Control and/or Warfare*	
7. Sensory irritant agents (CS)	Riot Control agents
8. Vomiting agents (DM)	Incapacitating agents (physical)

SECTION II—AGENTS LIABLE TO BE MET IN WARFARE

CHAPTER II

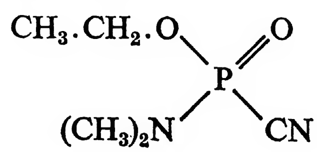
NERVE AGENTS

Introduction

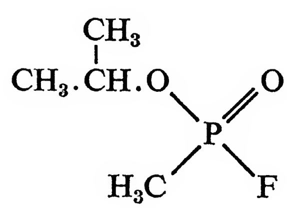
38. At the end of World War II stocks of a new type of chemical weapon were discovered in Germany. The filling, named "TABUN" by the Germans, was one of a series of compounds discovered during research on insecticides. It was found to be an acute systemic poison active in extremely low dosage, the toxic effects being similar to those caused by physostigmine and diisopropyl phosphorofluoridate (DFP). The high toxicity of the series had excited the interest of the German War Department, and work had been going on in secret since 1937.

39. Many compounds structurally related to TABUN have since been made, some of which are even more toxic. Those members of the series which are of military importance are now included in the generic term "Nerve Agents". Some of them have been given names, but they are more usually known by code letters, for example, GA, GB, GD, VX. The formulae of some of these compounds are shown below.

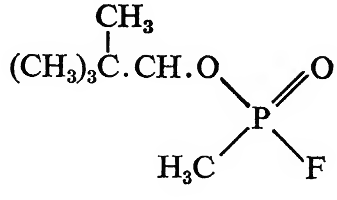
GA (Tabun)
0–Ethyl, N, N-dimethylphosphoramidocyamidate



GB (Sarin)
0–Isopropyl methylphosphonofluoridate



GD (Soman)
0–1,2, 2-Trimethylpropyl methylphosphonofluoridate



Physical and Chemical Properties

40. The nerve agents are all organo-phosphorus esters related to certain types of insecticide. They are liquids varying in volatility over a range similar to that between petrol and heavy lubricating oil. They have low freezing points, none freezing until $-40°C$.

(*a*) *Appearance*. Liquid nerve agents are pale yellow to colourless, but may have a slightly darker colour due to impurities. They are essentially odourless.

(*b*) *Stability*. Nerve agents are fairly soluble in water, being very slowly broken down by hydrolysis, yielding less toxic products. They are rapidly destroyed by strong alkalis and bleaching powder.

(*c*) *Powers of Penetration*. Normal clothing is penetrated by these agents whether contact is with the liquid or vapour state. Liquid agents usually penetrate by diffusion of vapour through the fabric. Leather is penetrated in the same manner as skin, but rubber, especially butyl rubber, and synthetic materials such as polythene are more resistant. Penetration of the Suit Protective NBC will not occur within 6 hours. The agent can penetrate into normally non-absorbent materials such as webbing, leather and wood and can continue to present a hazard by desorption of the vapour.

(*d*) *Persistence*. A wide variation in volatility between different members of the group leads to a wide range of persistencies. Additives may be used to alter the persistency of any one agent. The "G" agents are much less persistent than the "V" agents.

Detection

41. The agent can be detected by chemical means, and reactions which produce a colour change are made use of in equipment available for detection. The presence of liquid agent can be ascertained by using Detector Paper or Detector Powder, and of vapour by using the Residual Vapour Detector. In water, nerve agents can be detected in concentrations above 0·5 parts per million by the use of the Water Testing Kit, Poisons.

Protection

42. Ordinary clothing affords very little protection against nerve agent and special protective garments are required. The Suit Protective NBC, Gloves Protective NBC and the Respirator S6 NBC, give complete protection against these agents, in both the liquid and vapour state, for at least six hours. Before this period has elapsed, the suit and gloves should be changed. Boots which have a leather upper are slowly penetrated by the agent; additional protection can be gained by the use of overboots, and by the liberal use of fullers' earth inside the boot.

Decontamination

43. Liquid agent on the skin must be removed as soon as possible. Similarly, liquid agent must be removed from personal and unit equipment to prevent a continuing hazard.

(*a*) Decontamination of the skin is best carried out by means of the Decontamination Kit Personal No. 1. This contains pads which, when dabbed and rubbed on the skin, release fullers' earth powder. The powder soaks up the liquid and retains it by adsorption. For large areas of contamination and for items of personal equipment, such as webbing and small arms, the use of the Decontamination Kit Personal No. 2, which is a puffer bottle containing fullers' earth, is recommended.

(*b*) Expendable materials should be burned or buried. It should be remembered that if they are burnt, toxic vapours will be given off and due consideration must be given to the protection of individuals in the vicinity and downwind. Articles to be buried should be buried with a quantity of bleach slurry to ensure destruction of the agent.

(*c*) For large items of equipment such as vehicles or weapons, decontamination is best carried out by the use of the Decontaminating Apparatus NBC Portable or by scrubbing with bleach slurry. Hosing with water may remove most of the agent, but might spread contamination.

Mechanism of Action

44. Nerve agents inhibit the enzyme acetylcholinesterase. This enzyme hydrolyses acetylcholine, which is liberated when nerve impulses reach cholinergic nerve endings. The effect of a nerve agent is, therefore, to cause an individual to accumulate acetylcholine and so poison himself.

45. The parasympathetic nerve endings most obviously affected are those to the iris and ciliary body, those to the lachrymal and salivary glands, and those to the glands and muscles of the bronchial tree and gastrointestinal tract. Acetylcholine is also released in cardiac muscle from vagus stimulation and at the sympathetic nerve endings of the sweat glands. Symptoms due to an accumulation of acetylcholine at these sites are referred to as muscarinic symptoms and those due to acetylcholine accumulated at the neuromuscular junctions and the pre-ganglionic sympathetic synapses are referred to as nicotinic symptoms. In addition there are less well-defined central effects (Table II).

TABLE II

Pharmacology of Nerve Agents

Type of Action	*Site of Action*	*Response*
Muscarinic	Glands	
	Sweat	Increased Secretion
	Salivary	
	Nasal	
	Bronchial	
	Gastro-intestinal	
	Smooth Muscle	
	Bronchial	Constriction
	Cardiovascular	Bradycardia
	Iris	Miosis
	Gastro-intestinal	Increased mobility Colicky pain Diarrhoea
	Bladder	Involuntary micturition
Nicotinic	Pre-ganglionic synapses	Hypertension Pallor
	Neuromuscular junction	Weakness Muscular twitching Fasciculation Paralysis
Central	Central Nervous System	Apprehension Hyperexcitability Weakness Inco-ordination Convulsions Respiratory failure

46. The nerve agents are cumulative poisons, and repeated exposures to low concentrations, if not too widely separated, will eventually give rise to symptoms due to a gradual inhibition of acetylcholinesterase activity in the blood and tissues. Restoration of the cholinesterase activity to normal levels takes several weeks, but clinical recovery from acute effects usually takes place within a few days, due in part to a process of adaptation to lower levels of the enzyme.

Pathology

47. The damaging effects of nerve agents are on function and not on structure. Post mortem examination reveals signs consistent with death from asphyxia and there is usually evidence of blocking of the air passages with fluid secretions, if the case has not been treated with atropine, and oedema of the lungs. These, together with a decrease of acetylcholinesterase activity, which can be assayed in autopsy material, are the only objective signs.

Signs and Symptoms

48. These vary with the route and severity of poisoning. Some agents, *e.g.*, GA and GB, are normally vapours and others *e.g.*, VX, are normally liquids. The former attack principally by the respiratory route, the latter mainly through the skin.

49. *Respiratory route.* Poisoning may be mild or severe.

(*a*) *Mild poisoning.* Signs and symptoms may become noticeable within a few minutes of inhalation of even quite low concentrations of nerve agent. These are tightness of the chest, rhinorrhoea and salivation, miosis with dimming of vision and difficulty in accommodation accompanied by frontal headache.

These signs and symptoms are largely due to the local absorption of nerve agent and may be expected to persist for only a few hours, although headache and visual difficulties may last up to three days.

(*b*) *Severe poisoning.* The signs and symptoms referred to above become more pronounced; salivation and rhinorrhoea become so profuse that watery secretions run out of the sides of the mouth. Respiration becomes laboured because of obstruction from broncho-constriction and fluid in the airway, and audible wheezing will occur. Systemic effects from general absorption of the agent will become apparent leading to more marked miosis and severe sweating. Abdominal effects become prominent with profuse and uncontrollable vomiting, colicky pain and involuntary defaecation and micturition.

Muscular weakness occurs with fasciculation, convulsions and paralysis.

Death is due to asphyxia, and may occur within minutes.

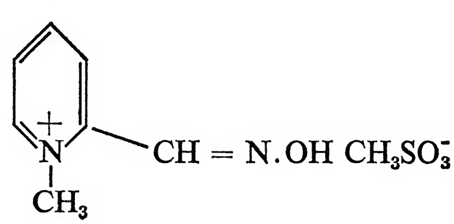
50. *Cutaneous route.* Local effects as described in para. 49a do not occur. The syndrome consists of those systemic effects described in para. 49b, preceded by general malaise. The progress of events is slower than in poisoning by the respiratory route.

51. *Gastro-intestinal route.* The onset of signs and symptoms from the ingestion of food and water contaminated with nerve agent is likely to be more rapid than the onset following skin absorption. The syndrome, however, is similar.

Treatment

52. The success or failure of treatment for nerve agent poisoning depends upon the speed with which the asphyxiating effect of the accumulated acetylcholine can be countered. This effect is due to three factors: first, paralysis of the respiratory muscles, especially the diaphragm; second, failure of the respiratory centre; and third, obstruction to air entry from broncho-constriction and the accumulated secretions. The two drugs at present used in the treatment of nerve agent poisoning are atropine and pralidoxime mesylate (oxime P_2S).

P_2S (Pralidoxime Mesylate) 2-Hydroxyiminomethyl-l-methylpyridinium methanesulphonate



To be fully effective these drugs must be used together: atropine reduces the sensitivity of the neurone or end-organ to accumulated acetylcholine; oxime, on

the other hand, acts by re-activating inhibited cholinesterase. GD, however, forms an irreversible complex with cholinesterase and is, therefore, resistant to oxime. It is important to note that the combined effects of atropine and hypoxia on the myocardium may rarely result in ventricular fibrillation.

53. The regime of treatment consists of pre-treatment, self aid, first aid and subsequent medical therapy in that order.

Pre-Treatment

54. The aim is to produce and maintain a therapeutically effective level of oxime in the blood. The dose required to achieve this is 4 g. every 6 hours. The standard pack, labelled Pralidoxime Mesylate (Oxime) Tablets, contains sufficient for 24 hours. Each dose consists of one quick release and three slow release tablets.

Pre-treatment must commence when a threat of chemical attack has been declared, and should continue for at least 36 hours after an attack with nerve agents, in order to protect against the late effects of slow absorption through the skin.

Mild loosening of the stools may be experienced by a proportion of those taking Oxime, but this does not interfere with normal activities.

Self Aid

55. (*a*) *Atropine.* The most urgent measure is the self administration of atropine immediately signs or symptoms of poisoning develop. Three automatic injection devices (Autoject), each containing 2 mg. of atropine, are carried in the respirator haversack. The second and third Autojects are used at 15 minute intervals if symptoms persist. Each injection is made through the clothing on the outer aspect of the middle of the thigh.

(*b*) *Pralidoxime mesylate* (oxime). An extra 4 g. dose of oxime should be taken following the first injection of atropine.

(*c*) *Decontamination.* Any skin exposed to liquid agent must be decontaminated.

First Aid

56. First aid must be rendered to any individual unable to aid himself: atropine injection and artificial respiration are the essential measures. The casualty's own autojects should be used.

The most effective form of artificial respiration is positive pressure: the Resuscitator NBC Portable should be used if available. Both the casualty and the resuscitator should be decontaminated as soon as possible—if necessary while artificial respiration is in progress. If no resuscitator is available, artificial respiration by mouth to mouth means can be carried out provided that the atmosphere is non-toxic and the casualty's face has been decontaminated. Manual methods (*e.g.*, Holger–Neilsen) are unlikely to be effective, but may be used if positive pressure methods cannot be employed, in which case the casualty should remain masked.

(Full details of all these methods of artificial respiration are given in Section VIII).

Artificial respiration must be continued until the casualty is breathing normally or for at least two hours.

Medical Therapy

57. Full medical treatment cannot be carried out in a toxic environment. Where possible the following regime of treatment is recommended:

(*a*) Complete decontamination of the casualty. Subject to life-saving requirements, this will consist of removal of the clothes and their disposal, and decontamination of the skin.

(*b*) A clear airway and artificial respiration must be maintained. A sucker may be required to remove excessive secretions.

(*c*) Atropine must be given until certain of the effects can be seen clinically. The required degree of atropinization is indicated by a dry mouth and a heart rate of 90–100 per minute. (Mydriasis may be an unreliable sign after nerve agent poisoning). This state should be maintained for 24 hours. The drug is conveniently administered in 2 mg. doses intravenously. Repeated doses will be needed as indicated by the pulse rate. Very large total doses, of the order of 200 mg., may be required in cases of severe poisoning. The medical officer should be alert to the signs of atropine poisoning which are a combination of central and peripheral nervous effects. The central action may produce euphoria, hallucinations, anxiety, restlessness, excitement and delirium, followed in severe cases by coma and depression of respiration. The more obvious peripheral effects are rapid pulse, dry mouth and throat, and dry hot skin. There may be hyperpyrexia. When oxime has been given after large doses of atropine, the possibility of atropine poisoning should be kept in mind.

A special preparation of atropine, containing 2 mg. in 1 ml. ampoules, is available for treatment of nerve agent or organophosphorus pesticide poisoning and this should be given by ordinary syringe and needle.

(*d*) Pralidoxime mesylate should be given concurrently in a dose of 1 g. intravenously every hour up to four injections. If the casualty's condition allows, oral dosage should be maintained. Oxime in ampoules, each containing 1 g. in 6 ml., is available for the treatment of nerve agent or organophosphorus poisoning.

(*e*) Treatment of ocular symptoms. The instillation of 1 per cent atropine eye drops or the application of 0·5 to 1 per cent atropine ointment into the eyes is more effective than parenteral atropine in relieving headache and ciliary spasm.

(*f*) If circumstances permit, treatment of severe nerve agent poisoning by curarization and intubation, after admission to hospital, should be considered.

Special Care in the Tropics

58. Since atropine inhibits sweating, extra care is required in tropical climates. Atropinization is still necessary in treating nerve agent casualties, but the possibility of heat effects must be borne in mind.

Course and Prognosis

59. The outlook depends upon the amount of agent absorbed and on the promptness and efficiency with which remedial measures are undertaken. Life can often be saved by treatment even though many times the lethal dose has been absorbed.

The function of the respiratory centre and muscular power returns, in most cases, within three or four hours. Recovery may not be immediately complete, however, and the danger of hypoxia remains for some hours due to recurrent bouts of muscular weakness.

Recovery, when it occurs, is likely to be complete in a few days, though heightened susceptibility to further exposure will persist for some weeks and tolerance does not develop.

60–61. *Reserved.*

CHAPTER III

LUNG DAMAGING AGENTS

Introduction

62. The most important member of this group is phosgene. It was used with great effect in World War I when it accounted for some 85 per cent of the deaths attributable to chemical agents.

Since the action of phosgene may be regarded as typical of that exerted by other members of this group it is the only agent discussed in this Chapter.

Other members of the group, also used in World War I are chlorine (paragraph 223) and chloropicrin (paragraph 222). Cyanogen chloride and bromide, which are classed as miscellaneous agents and discussed in Chapter VI, produce some effects similar to the lung-damaging agents.

PHOSGENE

Physical and Chemical Properties

63. Phosgene (carbonyl chloride: $COCl_2$) is a colourless gas readily condensed by pressure or low temperatures to a colourless liquid with a boiling point of 8°C. It has an odour resembling that of new-mown hay. Phosgene reacts rapidly with water to yield non-toxic hydrolysis products.

64. Although phosgene is a non-persistent agent, the vapour is somewhat heavier than air. It may, therefore, remain in dangerous concentrations in trenches, bunkers, valleys and woods for some considerable time depending on the atmospheric conditions.

Detection

65. There is no device available for the detection of this agent.

Protection

66. Full protection is afforded by the Respirator S6 NBC.

Decontamination

67. Because of its physical properties the agent will not remain long in its liquid state. Decontamination is not, therefore, necessary.

Mechanism of Action

68. Phosgene increases the permeability of the alveolar capillaries with resultant pulmonary oedema. This interferes with pulmonary gaseous exchange leading to anoxia. The loss of fluid into the alveoli also results in haemoconcentration which, together with the anoxia, causes cardiac embarrassment which may proceed to cardiac failure.

Pathology

69. The outstanding feature of phosgene poisoning is massive pulmonary oedema. This is preceded by damage to the bronchiolar epithelium, development of patchy areas of emphysema, partial atelectasis, and oedema of the perivascular connective tissue.

The trachea and bronchi are usually normal in appearance. This contrasts with the findings in chlorine and chloropicrin poisoning in which both structures may show serious damage to the epithelial lining with desquamation.

The lungs are large, oedematous and darkly congested. Oedema fluid, usually frothy, pours from the bronchi and may be seen escaping from the mouth and nostrils.

With exposure to very high concentrations death may occur within several hours; in most fatal cases pulmonary oedema reaches a maximum in 12 hours followed by death in 24–48 hours.

If the casualty survives, resolution commences within 48 hours and, in the absence of complicating infection, there may be little or no residual damage.

Signs and Symptoms

70. On exposure to phosgene there may be some irritation of the eyes and respiratory tract. This is manifested by smarting with lachrymation, catching of the breath with coughing, choking and a sensation of tightness and pain in the chest. Nausea, retching, and vomiting may develop, interfering with the wearing of the respirator.

The severity of these initial symptoms is no guide to prognosis since casualties with severe symptoms may fail to develop any serious lung damage, whereas others with little initial irritation may later develop fatal pulmonary oedema.

Following these initial symptoms there is, usually, a latent period during which the casualty suffers little discomfort and has no abnormal chest signs. This period may last for between 30 minutes and 24 hours. Severe exertion during this time may precipitate serious or fatal respiratory or cardiac symptoms.

The latent period is followed by the development of the signs and symptoms of pulmonary oedema. These begin with rapid shallow breathing, cyanosis, and painful cough with the expectoration of increasing quantities of frothy white or yellowish liquid. As the oedema progresses, discomfort, dyspnoea and apprehension increase. Examination of the chest reveals diminished breath sounds with rales and rhonchi in all areas.

Concurrently with these symptoms haemoconcentration develops which, together with anoxia, produces cardiac embarrassment. The pulse weakens and the rate increases to the order of 130–140 beats per minute. Circulatory collapse and cardiac failure may follow.

Of the fatal cases some 80 per cent die within 48 hours of exposure. The subsequent development of bronchopneumonia accounts for a number of deaths after this period.

Treatment

71. The initial symptoms are not reliable in prognosis, and, although it may be inevitable that men who have been exposed to phosgene must continue the battle, strenuous activity predisposes to the development of pulmonary oedema.

If, however, symptoms of respiratory distress occur, indicating the onset of pulmonary oedema, the usual therapeutic measures for this condition should be commenced without delay. Initially these measures should consist of warmth, strict rest and oxygen if available.

The casualty should be kept comfortably warm, but care must be taken to avoid over-heating.

Rest may be disturbed by anxiety, restlessness and coughing. The latter may be controlled by codeine phosphate in a dosage of 30–60 mg. and the use of morphine should be considered. It is important, however, to weigh the merits of sedation against further depression of the respiratory centre.

Oxygen, the most beneficial treatment, is indicated where there is cough, dyspnoea, cyanosis or restlessness. Where possible, it should be administered initially in high concentration and at positive pressure (hyperbarically). Artificial respiration is contra-indicated.

In addition to the above, antibiotics should be given to prevent pulmonary infection.

72–73. *Reserved.*

CHAPTER IV

VESICANT AGENTS

Introduction

(MUSTARD GAS)

74. These are substances which act primarily by damaging the skin, eyes, mucous membranes and the subcutaneous tissues, though remote effects may also occur after absorption into the body.

Sulphur mustard ("mustard gas") was developed by the Germans in 1917 and proved to be the most effective chemical agent used in the first World War. It is estimated that some 168,000 casualties were caused by its use. Since the first World War, sulphur mustard has been used effectively in Abyssinia, but has not been known to have been used in any other conflict.

These agents can be employed in any weapon system with resultant dissemination as liquids, aerosols or vapours.

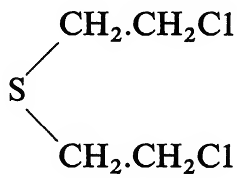
75. The vesicant agent group includes the following:

(*a*) Sulphur mustard ("mustard gas").
(*b*) The nitrogen mustards.
(*c*) The arsenical vesicants—Lewisite and "The Dicks".
(*d*) Phosgene oxime.

SULPHUR MUSTARD

Physical and Chemical Properties

76. (*a*) Sulphur mustard is Bis (2-chloroethyl) sulphide



$(ClCH_2.CH_2)_2S$

It is normally a liquid, boiling point 217°C., freezing point 14·4°C., but when encountered as a weapon of war its physical properties may be significantly altered by additives. The specific gravity of the pure substance is 1·3 and, therefore, it sinks in water leaving only a thin film on the surface.

(*b*) *Appearance.* It is an oily liquid, varying from colourless to dark brown, according to its purity.

(*c*) *Odour.* Sulphur mustard has a fairly characteristic odour reminiscent of garlic. However, detection by smell is unreliable particularly by those who are unfamiliar with it or who do not suspect its presence. Further, the sense of smell tires quickly and a rising concentration in the air may thus escape notice.

(*d*) *Solubility.* Although sulphur mustard is only very slightly soluble in water (less than 1 per cent), both the liquid and vapour are readily soluble in oils, fats and organic solvents.

(*e*) *Stability.* It is both physically and chemically stable and is unaffected by normal ranges of atmospheric temperature. It is only slowly hydrolysed by water to hydrochloric acid and thiodiglycol. Strong oxidizing agents are required to neutralize it, bleaching powder (see para. 153) being particularly effective. (N.B. If bleaching powder is used as a decontaminant it should be mixed to a slurry with water. Use of the dry powder on sulphur mustard results in spontaneous combustion).

(*f*) *Powers of Penetration.* Sulphur mustard will eventually penetrate all but the most impervious substances such as metals, glass and glazed tiles. Both liquid and vapour readily penetrate ordinary clothing, especially woollens which contain natural oils in their fibres. When droplets of

liquid agent fall on to clothing the injury that may result to the underlying skin is usually caused by vapour which has passed through the material rather than by liquid itself. Slower penetration occurs through rubber and synthetic materials such as polythene. Penetration of the Suit Protective NBC will not occur inside six hours.

(*g*) *Persistence*. The liquid agent vaporises very slowly at room temperature and is therefore very persistent. In certain weather conditions it may remain in the liquid or frozen state, giving off vapour slowly for days, weeks or even months. Additives may be used to alter its persistence. Liquid or frozen agent may be carried by boots and other items of equipment to warmer surroundings where vaporization will occur. The agent may also persist under the surface of ground which appears to be free from contamination and which may prove dangerous for years if it is disturbed. Where the agent has been absorbed by materials or structures, it will continue to present a vapour hazard by desorption.

(*h*) *Influence of Tropical Climate*. High atmospheric temperatures markedly increase the rate of vaporization of the agent; hot humid weather in particular significantly increases the rapidity and degree to which sulphur mustard affects the skin.

Detection

77. The agent can be detected by chemical means, and reactions which produce a colour change are used in the equipment available for detection. The presence of liquid can be ascertained by using Detector Paper or Detector Powder and of vapour by using the Residual Vapour Detector.

In water, sulphur mustard can be detected in concentrations of 2 parts per million and above by means of the Water Testing Kit, Poisons.

Protection

78. Ordinary clothing affords very little protection against sulphur mustard and special protective garments are required. The Suit Protective NBC and Gloves Protective NBC, when worn with the Respirator NBC S6 give complete protection against the agent, in both the liquid and vapour state, for at least 6 hours. Before this period has elapsed, the suit and gloves should be changed. Boots which have a leather upper are slowly penetrated by the agent; additional protection can be gained by the use of overboots, or by the liberal use of fullers' earth inside the boot.

Decontamination

79. Liquid agent which has come into contact with the skin must be removed as soon as possible. Similarly, liquid agent must be removed from personal and unit equipment to prevent a continuing hazard.

(*a*) Decontamination of the skin is best carried out by means of the Decontamination Kit Personal No. 1. This contains pads, which, when dabbed and rubbed on the skin, release fullers' earth powder. The powder soaks up the liquid and retains it by adsorption. For large areas of contamination and for items of personal equipment, such as webbing and small arms, the use of the Decontamination Kit Personal No. 2, which is a puffer bottle containing fullers' earth, is recommended.

(*b*) Expendable materials are best dealt with by burning or burying. It should be remembered that if they are burnt toxic vapours will be given off and due consideration must be given to the protection of individuals in the vicinity and the downwind hazard. When articles are buried they should be buried with a quantity of bleach slurry to ensure destruction of the agent. OR, SCRUB EQUIPMENT WITH BLEACH SLURRY

Plate III. Effect of Liquid Sulphur Mustard on the Skin.
Blisters appearing on the skin 24 hours after exposure to liquid sulphur mustard.

CHAPTER V

INCAPACITATING AGENTS

Introduction

99. Incapacitating agents are substances which impair the subject's ability to carry out his duties, but the use of which does not incur serious risk of death or permanent injury. Lethal agents in sub-lethal doses and blister agents, both of which may cause permanent injury, and riot control agents are excluded from this category.

100. Incapacitating agents are classified as physical incapacitants or psychotomimetic agents according to whether their action is predominantly upon the physical or mental activities of the subject.

PHYSICAL INCAPACITANTS

101. Possible mechanisms of physical incapacitation are many, but the criterion that no serious risk of death or permanent injury should result means that no practical physical incapacitant is known at present, although the vomiting agent D.M. (See Chapter VII) is described as a physical incapacitant in the Service Classification (Table I).

PSYCHOTOMIMETIC AGENTS

102. There are many drugs which act upon the central nervous system to produce incapacitation; few of these are sufficiently potent and safe, or possess the necessary chemical and physical properties, to make them potential chemical agents. Of these few, BZ, an atropine-like drug, is the most important, but lysergic acid diethylamide (LSD 25) and other similar drugs, merit consideration.

BZ

Physical and Chemical Properties

103. BZ is a crystalline solid at normal temperatures and sufficiently stable to be disseminated as a smoke from a pyrotechnic device.

Detection

104. There is no device at present available for the detection of this agent.

Protection

105. Full protection is afforded by the Respirator S6 NBC and Suit Protective NBC.

Mechanism of Action

106. BZ acts by blocking the activity of cholinergic synapses in a manner similar to that of atropine. Unlike atropine, BZ produces predominantly central rather than peripheral effects.

Signs and Symptoms

107. In 1–2 hours after exposure, BZ produces atropine-like effects, such as dilation of the pupils, dry mouth and increased heart rate, followed later by ataxia and drowsiness. These effects, apart from the mydriasis, give way after 6 or 7 hours to a confused mental state, in which delusions, hallucinations and aimless behaviour are common, and may persist for several days. During this phase the subject may injure himself and others. Memory for the period of the intoxication may be lost or fragmentary. The mydriasis may persist for 3 days.

Treatment

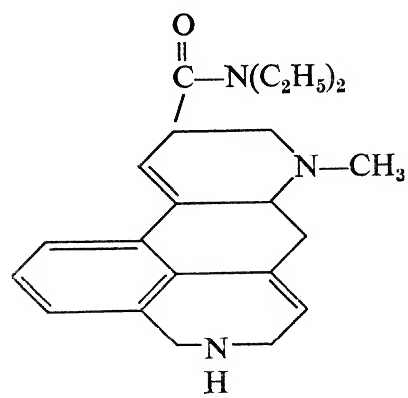
108. In the majority of casualties, symptomatic treatment is all that will be necessary. Firm restraint when necessary and a friendly attitude are called for, especially in dealing with those subjects who are capable of walking. All dangerous objects must be removed and anything likely to be swallowed should also be kept from the subject as bizarre delusions may occur. Body temperature should be observed, as heat stroke may occur, especially in tropical climates. Fluid intake must be maintained.

Physostigmine, which is used as an antidote to BZ, should be reserved for casualties who appear to be in danger. Where this treatment is deemed to be necessary, an injection of 2–3 mg. will be required to alleviate the condition. Repeated injections at intervals of 15–30 minutes may be required to avoid relapse.

Neostigmine, because it does not penetrate the central nervous system as well as physostigmine, is considerably less effective.

LSD 25

LSD 25 D-Lysergic acid diethylamide



Signs and Symptoms

109. The clinical manifestations of LSD intoxication often include an early stage of nausea, followed 45–60 minutes after dosage by a confused state in which delusions and hallucinations are common, but not always experienced. There is some evidence that the effects may be held off, at least for a time, by determination to continue duty, and that the presence of undrugged comrades enables affected subjects to maintain contact with reality. Recovery is spontaneous and is usually complete within 12 hours.

Treatment

110. The best treatment known at present for LSD intoxication is the administration of sodium amytal (200–400 mg. intravenously) to sedate the patient until spontaneous recovery occurs. Chlorpromazine has also been suggested for therapy, but does not appear to have any advantage over sodium amytal.

OTHER DRUGS

111. The phenothiazines and cannabinols, although they seem to act primarily by depressing the central nervous system, are not considered likely to be used in warfare owing to the relatively large doses required to produce an effect.

112–113. *Reserved.*

CHAPTER VI

MISCELLANEOUS AGENTS

Introduction

114. There are a number of agents which do not readily lend themselves to pharmacological classification; these include cyanide type agents and arsine. This Chapter considers the former type; arsine is discussed in Chapter XIII.

The use of cyanide agents was initiated by the French in 1916 with the employment of shells filled with hydrogen cyanide. However, because of its extreme volatility and the fact that the vapour is lighter than air, it was found almost impossible to establish a lethal concentration in the field by this means of delivery. In an attempt to overcome this disadvantage the related substances, cyanogen chloride and cyanogen bromide, were produced, the vapours of which are several times heavier than air.

With modern weapon systems, it is certainly possible to produce a lethal field concentration of hydrogen cyanide and therefore knowledge of the effects of this agent is essential.

115. The agents in this group, known also as "Blood Agents", are:

(*a*) Hydrogen cyanide.
(*b*) Cyanogen chloride (CNCl)
(*c*) Cyanogen bromide.

The latter two compounds, after absorption from the lung, react with haemoglobin in such a way that hydrogen cyanide is eventually released. Their effects on the body, therefore, are essentially similar to those of hydrogen cyanide. The rest of this chapter deals with hydrogen cyanide, but the main points of difference of the other two agents are indicated.

HYDROGEN CYANIDE

Physical and Chemical Properties

116. Hydrogen cyanide is a clear, colourless liquid with a boiling point of 26°C. It is very volatile and the vapour, being somewhat lighter than air, disperses rapidly after release. It has a smell of bitter almonds which may be noticed in concentrations as low as 1 part per million. This is well below the danger level, but is unreliable as a means of detection. Hydrogen cyanide is soluble in water producing a weak acid solution.

Detection

117. At present there is no automatic device available to the Services for the detection of these agents in the vapour state, but a Draeger tube can be used. Cyanide in water can be detected in a concentration of 20 parts per million using the Water Testing Kit, Poisons.

Protection

118. Full protection against these agents is afforded by the Respirator S6 NBC and the Suit Protective NBC. However, these agents seriously impair the effectiveness of the respirator filter which is best changed after a single exposure to them.

The protective suit is necessary for full protection since the agents, in their liquid state, can be absorbed through the skin.

Decontamination

119. Because of its physical properties the agent will not remain for long in its liquid state. Decontamination should not, therefore, be necessary.

Mechanism of Action

120. The cyanide ion reversibly complexes with the respiratory cytochrome oxidase enzyme system which results in impairment of cellular oxygen utilisation. The central nervous system, particularly the respiratory centre, is especially susceptible to this effect and respiratory failure is the usual cause of death.

Pathology

121. With exposure to high concentrations sufficient hydrogen cyanide may be inhaled in a few breaths to cause immediate death by respiratory failure. In these cases no pathological changes are demonstrable. The blood remains well oxygenated and the skin has a pink colour similar to that seen in carbon monoxide poisoning.

In cases where death is delayed, following exposure to lower concentrations, small areas of haemorrhage and softening of the brain may be seen due to anoxic damage.

Where exposure is to sub-lethal concentrations, cyanide is detoxicated in the body to harmless thiocyanate. This reaction is catalysed by intracellular transsulphurase enzymes, one of which requires thiosulphate as a substrate. The limiting factor in cyanide detoxication is the amount of available intracellular reducing sulphur which can serve as, or be transferred into, substrate. This reducing sulphur is available, *in vivo*, in the form of thiosulphate, cystine and cysteine.

In addition to the systemic effects outlined above, cyanogen chloride and bromide also have local irritant effects on the eyes and the respiratory tract similar to those of the choking agents. There may be severe inflammatory changes in the bronchioles with congestion and pulmonary oedema.

Signs and Symptoms

122. The more rapidly the tissue cyanide levels build up, the more acute are the signs and symptoms of poisoning and the smaller is the total absorbed dose required to produce a given effect.

In high concentrations there is an increase in the depth of respiration within a few seconds. This stimulation of respiration may be so powerful that a casualty cannot voluntarily hold his breath. Violent convulsions occur after 20 to 30 seconds with cessation of respiration within 1 minute. Cardiac failure follows within a few minutes.

With lower concentrations the early symptoms are weakness of legs, vertigo, nausea and headache. These may be followed by convulsions, and coma which may last for hours or days depending on the duration of exposure to the agent. If coma is prolonged, recovery may disclose residual damage to the central nervous system manifested by irrationality, altered reflexes and unsteady gait, which may last for several weeks or longer; temporary or permanent nerve deafness has also been described.

In mild cases there may be headache, vertigo and nausea for several hours before complete recovery.

With cyanogen chloride and bromide the above systemic effects are modified by their irritant properties. Exposure is followed by intense irritation of the eyes, nose and throat, with tightness of the chest and coughing. Severe lachrymation and blepharospasm may occur. Vertigo, headache and dyspnoea follow which may proceed to convulsions, coma and death. In non-fatal cases pulmonary oedema often develops, which gives rise to a persistent cough with frothy sputum, severe dyspnoea, and marked cyanosis.

Treatment

123. The success or failure of treatment for acute cyanide poisoning depends upon the speed with which cellular oxygen utilisation can be restored. This may be facilitated either by the production of methaemoglobin which also complexes with the cyanide ion, or by the introduction of thiosulphate which assists the detoxication to harmless thiocyanate. Recent work has indicated, however, that

immediate treatment with dicobalt edetate, which fixes the cyanide ion directly, is more effective.

Where possible, treatment should be initiated by the intravenous injection of 20 ml. (300 mg.) of a solution of dicobalt edetate ("Kelocyanor"). Several ampoules may have to be given if the patient does not rapidly recover consciousness. Failing this, an intravenous injection of 10 ml. of a 3 per cent solution of sodium nitrite should be given, followed through the same needle by 25 to 50 ml. of a 50 per cent solution of sodium thiosulphate.

Where intravenous therapy is not immediately available, the first step in treatment is the inhalation of amyl nitrite and two ampoules should be crushed in the hollow of the hand and held close to the casualty's nose. Artificial respiration should be commenced, if respiration has ceased or is feeble, to maintain ventilation and thus facilitate the inhalation. The dose of amyl nitrite should be repeated every few minutes to a total of eight ampoules.

Oxygen, if available, should be administered preferably by positive pressure, but because of the danger of explosion when oxygen is mixed with amyl nitrite, the latter should not be given under an oxygen face mask.

In most cases of exposure to hydrogen cyanide there is either rapid death or prompt recovery. With cyanogen chloride and bromide the same applies as far as the systemic effects are concerned. Pulmonary effects may develop immediately or be delayed until after the systemic effects have subsided. These effects should be treated in the same way as phosgene poisoning. (See Chapter III).

124–125. *Reserved.*

FURTHER READING :—

Cobalt Compounds as Antidotes for Hydrocyanic Acid.
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Medical Cover Required in Large Scale Production of Cyanide and Hydrocyanic Acid.
Knowles, E. L. and J. T. B. Bain (1968) Chemistry and Industry 24 Feb. 1968, 232.

Treatment of Chemical Agent Casualties USA.
Dept. of Army, Navy and Air Force.
TM 8–285 NAUMEDP–5041 AFM 160–12/15 Jan. 1968.

SECTION III—AGENTS LIABLE TO BE MET IN RIOT CONTROL AND/OR WARFARE

CHAPTER VII

RIOT CONTROL AGENTS

Introduction

126. Riot control agents are chemicals that produce irritating or disabling effects when in contact with the eyes, or when inhaled. Although there is an overlap in the symptoms produced, they may be classified as sensory irritant agents and vomiting agents.

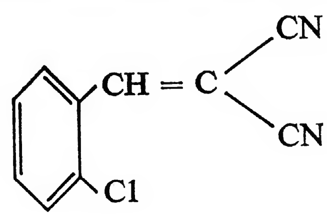
Although their primary use is for riot control, some of them may be encountered in the course of military operations. Sensory irritant agents are also used in training.

SENSORY IRRITANT AGENTS

General

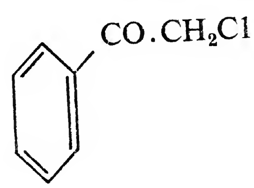
127. The most important member of this group is *o*-chlorobenzylidene malononitrile, commonly known as CS.

CS *O*-chlorobenzylidenemalononitrile



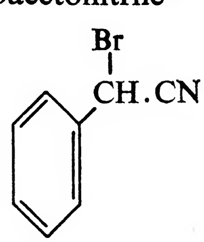
Other substances used as tear agents are (ω-chloracetophenone (CAP or CN) and bromobenzyl cyanide (BBC) which differ somewhat from CS in their physical and chemical properties; these agents are not used by British troops.

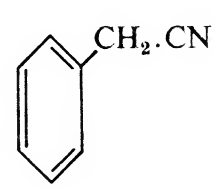
CN *ω*-chloracetophenone



BBC Mixture of 70% phenylbromoacetonitrile and 30% phenylacetonitrile

Phenylbromoacetonitrile Phenylacetonitrile





CS acts more quickly, is more potent and less toxic than the other riot control agents. No death or serious injury due to CS has been authenticated, whereas high concentrations of CN have caused corneal scarring, and a small number of deaths have occurred from its use in confined spaces. Further discussion in this chapter is concerned primarily with CS, but details of treatment will apply equally to the effects of CN.

128. *Reserved.*

SECTION IV—PUBLIC HEALTH ASPECTS

CHAPTER VIII

CONTAMINATION OF FOOD AND WATER

Introduction

141. Food and water cannot easily be decontaminated. Supplies must, therefore, be protected as completely as possible.

Food and water may be contaminated by chemical agents whether in the vapour, aerosol or liquid state. The most dangerous contamination is from nerve and blister agents since these are likely to be disseminated as liquids and they are more readily absorbed by foodstuffs. Exposure to high concentrations of the vapours of other agents may make food unpalatable or unfit for consumption.

FOOD

Susceptibility to Contamination

142. Nerve and blister agents are readily soluble in oils and fats. Food with a high fat content can absorb large quantities of these agents when exposed to liquid or vapour, which may diffuse throughout the material.

Liquid agents will also penetrate foods of low fat content, rendering them dangerous, but foods of this type may not absorb significant quantities of vapour.

Foods of high water content, contaminated by agents which are easily hydrolysed, may be made unpalatable by the formation of acid products of hydrolysis.

Protection of Food

143. Liquid or vapour may penetrate wooden and cardboard boxes, or paper wrappings, in sufficient quantities to make consumption of food within these packages dangerous. Sealed polythene will give good protection against vapour, but is penetrated by liquids in minutes to hours depending on the thickness of the material. Only food sealed in impervious containers, such as tins, glass or glazed earthenware jars, and foil wrappings, is completely protected against chemical agents.

Decontamination

144. When it is known or suspected that impervious containers have been contaminated they must be thoroughly decontaminated before being opened. (See Chapter IX).

If it is known or suspected that other types of container have been contaminated, the contents must be assumed to be contaminated. Where contamination is with liquid nerve or blister agent the whole contents must be condemned. Certain food contaminated by chemical agent *vapours* can be rendered safe by exposure to the air followed by cooking. (See Table III). *If there is any doubt that a particular food is safe to eat it must be condemned.*

WATER

145. Open water sources may become contaminated by direct chemical attack on an area, or by the catchment of water from such an area. In either case, concentrations sufficient to produce casualties may result. Water from deep sources, such as springs or wells, is less likely to be contaminated.

TABLE III

Effects of Chemical Agents on Food

		High Fat Content (Butter, fats, milk, cheese, meat, bacon, etc. and shell eggs).	Low Fat High Moisture Content (Fruit, vegetables, sugar, salt, etc.).	Low Fat Low Moisture Content (Cereals, tea, coffee, flour, bread, rice, etc.).
Nerve Agents	Liquid	All foods to be condemned.		
	Vapour	To be condemned.	Dry foods should be exposed to the air for 48 hours. Other foods should be washed with 2 per cent sodium bicarbonate solution, peeled where applicable, and cooked by boiling.	
Blister Agents	Liquid	All foods to be condemned.		
	Vapour	To be condemned.	As for foods contaminated with nerve agent vapour.	
Choking Agents		Agents decompose rapidly on contact with water. Food should be washed with water where possible and exposed to the air for 24 hours. Food may be made unpalatable by acid products of hydrolysis.		
Cyanide—Type Agents		Unlikely to produce dangerous contamination of foodstuffs.		
Riot Control Agents		Food may be made unpalatable to the extent of being inedible.		

SECTION V—DECONTAMINATION

CHAPTER IX

DECONTAMINATION

Introduction

149. Decontamination is a difficult and lengthy process, the need for which should be minimised by keeping personnel and equipment under cover whenever possible. This will reduce the chance of contamination by direct attack or by pick-up from contaminated objects.

150. Chemical agents of low volatility, which have been disseminated in the liquid state, can continue to present a hazard and cause casualties for days, weeks or even months. To minimise this hazard, decontamination of personnel and equipment must be carried out as soon as possible.

DECONTAMINATION OF PERSONNEL AND EQUIPMENT

Stages of Decontamination

151. There are three stages:

(*a*) *Immediate Decontamination.* This is the removal of chemical agent from exposed parts of the body after a liquid attack, and from those items of personal equipment which come into contact with the body. It follows the immediate action drill (see Appendix A) as soon as the operational situation allows. *To be fully effective, decontamination of the skin must be completed within five minutes of contamination.* The drill for carrying out immediate decontamination is fully described in Appendix A to this chapter.

(*b*) *Operational Decontamination.* The aim of this stage is to reduce the hazard from gross contamination of protective clothing caused by contact with contaminated equipment. It is a continuing process whenever time and the operational situation allow. It consists particularly of decontamination of those parts with which contact is probable during use, operation or maintenance of vehicles or equipment.

(*c*) *Unit Decontamination.* Here the aim is to remove the contamination completely from all the unit's equipment. This is a major task which cannot be performed whilst maintaining an operational role.

Methods of Decontamination

152. Decontamination can be effected by:

(*a*) Destroying the agent by chemical or physical means.

(*b*) Removing the agent by using solvents or adsorbents, or by washing.

(*c*) Weathering.

In addition the agent can be rendered harmless by sealing contaminated articles in impermeable containers or by burying them deep in the ground.

153. Destruction

(*a*) *Chemical*

(1) Bleaching Powder is issued as a general purpose decontaminant. It destroys all known chemical agents. For use it should be mixed to a slurry with water and applied by brushing on to the surface to be decontaminated. Bleaching Powder must not be used dry, since if it comes into contact with certain agents it catches fire.

TABLE IV

Summary of Agents, Properties, Methods of Recognition and First Aid

Agent	Recognition	Clinical Effects	Self Aid	First Aid	Remarks
Nerve Agent G agent—(non-persistent) V agent—(persistent)	Colourless gas and colourless to pale yellow liquid. Detector paper or powder change colour in presence of liquid. For vapour, use Residual Vapour Detector and in water use Water Testing Kit, Poisons.	Tightness of chest; headache; rhinorrhoea and salivation; miosis and dimming of vision; nausea and vomiting; sweating; convulsions; dyspnoea; respiratory failure.	Atropine by autoject immediately evidence of poisoning. Repeat twice at 15 minute intervals if symptoms persist. Extra 4 g. dose of oxime taken following injection of atropine. Decontamination of skin exposed to liquid agent.	Atropine by autoject and artificial respiration if necessary. Inject oxime. Decontamination of casualty and resuscitator.	Speed is vital in treating casualties. Atropine must be given as soon as possible. Personnel at risk should already be taking 4 g. oxime every 6 hours.
Lung damaging Agent Phosgene (non-persistent)	Colourless gas which may form white cloud. Smell of new-mown hay. No device available for detection.	Lachrymation; coughing; choking; tightness in the chest with pain. Nausea and vomiting. Latent period 30 minutes —24 hours followed by signs and symptoms of pulmonary oedema. Haemoconcentration, anoxia, circulatory collapse.		Warmth, strict rest and oxygen if available. Coughing controlled by linctus codeine.	Initial symptoms not of reliable prognostic significance.
"Cyanide-type" Agents Hydrogen cyanide (non-persistent)	Colourless gas or volatile liquid. Smell of bitter almonds. No device available to detect vapour. Detected by Water Testing Kit, Poisons.	Mild cases: headache, nausea and vertigo. Higher concentrations, in addition, convulsions and coma. High concentrations: increase in depth of respiration; violent convulsions and cessation of respiration within 1 minute.		Artificial respiration preferably by positive pressure and oxygen if available. Intravenous injection of 20 ml. dicobalt edetate or 10 ml. of 3 per cent sodium nitrite followed by 25–50 ml. of 50 per cent sodium thiosulphate. Amyl nitrite inhalations.	Usually there is either rapid death or prompt recovery. Speed in treatment is most urgent. Canister life of respirator shorter than for other agents.
Cyanogen chloride Cyanogen bromide (non-persistent)		Above systemic effects modified by irritant properties involving eyes, nose and throat with tightness of chest and coughing.		As above.	

TABLE V

Summary of Clinical Effects of Chemical Agents and their Differential Diagnosis

1. Skin		
(*a*) Colour	Grey or cyanosed	*Lung damaging agent*—(late effects) respiration increased, cough, pain and dyspnoes, followed after latent period by expectoration and evidence of pulmonary oedema (transient cough—*sensory irritants* and *vomiting agents*).
		"*Cyanide type*" *agent*—respiration slowed with increased depth, followed by cessation of respiration.
		Nerve agent (late effects)—Laboured respiration from broncho-constriction and fluid in airway.
	Erythema	*Sensory irritant agent*—transient blotchy pattern, especially on moist areas on exposure to high concentrations (transient effect on eyes and respiratory tract).
		Vesicant agent—prolonged effect followed by vesication and/or blistering. (May be associated with severe effects on the eyes and respiratory tract).
(*b*) Sweating	Excessive	*Nerve agent*—also salivation, rhinorrhoea and excessive bronchial secretions (transient salivation and rhinorrhoea from *sensory irritants* and *vomiting agents*).
	Diminished	*Psychotomimetic agent* (BZ).
2. Eyes		
(*a*) Red and watering		*Sensory irritant agents and vomiting agents*—transient effects only.
		Vesicant agents—also oedema of eyelids, severe conjunctivitis and oedema of cornea. Temporary or permanent blindness.
(*b*) Pupil	Miosis	*Nerve agent*.
	Mydriasis	*Psychotomimetic agent* (BZ).

3. CNS Effects

- (*a*) Mental state
  - Disinterested, aloof and unresponsive to commands—*Psychotomimetic agent e.g., LSD.*
  - Confused with delusions and aimless behaviour
    - *Psychotomimetic agent e.g., BZ.*
    - "*Cyanide-type*" *agent* (delayed effect with residual brain damage).
  - Depression —— *Vomiting agent*, severe effect.
- (*b*) Neuromuscular
  - Unsteady gait and weakness
    - *Vomiting agent*, associated with sensory irritant effects.
    - *Psychotomimetic agent LSD or BZ*, associated with mental symptoms.
    - "*Cyanide-type*" *agent*, with residual brain damage.
  - Muscular weakness with fasciculation —— *Nerve agent*, associated with convulsions.
  - Paralysis —— *Nerve agent.*
- (*c*) Convulsions
  - Terminal
    - *Nerve agent.*
    - "*Cyanide-type*" *agent*, severe effects.
  - Delayed —— "*Cyanide-type*" *agent*, mild effects.

4. Abdominal Effects

- (*a*) Vomiting
  - *Nerve agent*—profuse and uncontrollable, with other effects of systemic poisoning.
  - *Vomiting agent*—associated with nausea and vertigo, and sensory irritant effects.
  - *Lung damaging agent*—associated with excessive coughing.
  - *Sensory irritant agent*—in high concentrations associated with excessive coughing.
  - "*Cyanide-type*" *agent*—occasionally seen in mild cases associated with nausea and vertigo.
- (*b*) Incontinence of urine or faeces —— *Nerve agent* in near lethal exposure.

GREAT BRITAIN

AND THE

EUROPEAN CRISIS.

[or how E. Grey caused WWI!]

SHOWS HOW CRISES & MOBILIZATIONS ARE EXPLOITED AS EXCUSES FOR WAR.

CORRESPONDENCE, AND STATEMENTS IN PARLIAMENT, TOGETHER WITH AN INTRODUCTORY NARRATIVE OF EVENTS.

[TOP SECRET MEMOS PUBLISHED WHEN IT, WAR, TOO LATE TO AVOID!]

(See also chapter about Grey's Liberal diplomacy failure in Lloyd George, "War Memoirs".)

(Grey believed in ambiguity and vagueness. This ended deterrence thus causing WWI)

(NOTE: Edward Grey REFUSED repeatedly to DETER Germany by stating DEFINITELY that invasion of Belgium would trigger off the First World War.

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INTRODUCTORY NARRATIVE OF EVENTS.

(1.)

On the 23rd June, 1914, the Archduke Francis Ferdinand, nephew of the Emperor of Austria, Heir to the Throne, and Commander-in-Chief of the Army, left Vienna to attend army manœuvres in the Province of Bosnia. On Sunday, the 28th, he visited Sarajevo, the capital of the province, and made a progress through the town accompanied by his wife, the Duchess of Hohenberg. While passing through the streets their automobile was fired on by an assassin. Both the Archduke and Duchess were killed.

No crime has ever aroused deeper or more general horror throughout Europe; none has ever been less justified. Sympathy for Austria was universal. Both the Governments and the public opinion of Europe were ready to support her in any measures, however severe, which she might think it necessary to take for the punishment of the murderer and his accomplices.

It immediately appeared, from the reports of our representatives abroad, that the press and public opinion of Austria-Hungary attributed much of the responsibility for the crime to the Servian Government, which was said to have encouraged a revolutionary movement amongst the Serb populations of Bosnia and Herzegovina.

That there had for many years been a strong Serb nationalist movement in these two provinces there is no doubt. This movement in an earlier form had swept the provinces, then part of the Turkish Empire, into the insurrection against the Turkish Government in the seventies of last century, culminating in the war of 1877-8 between Russia and Turkey. It had continued when Austria took over the administration of the provinces under the Treaty of Berlin in 1878. Austria then pledged her word to Turkey that her occupation should not "detract from the rights of sovereignty of His Majesty the Sultan over these provinces." Thirty years later, however, in 1908, she suddenly proclaimed their annexation to her Empire. On the 7th October of that year, the annexation was celebrated in Sarajevo by the firing of salutes and ringing of cathedral bells, amid scenes of official rejoicing and popular apathy. Servian nationalist feeling immediately asserted itself, and the Servian Government protested to the Powers against the annexation as a "deep injury done to the feelings, interests, and rights of the Servian people." Servia's attitude, coupled with the resentment felt by Russia and certain other Great Powers, nearly brought about a European war; but after six months of extreme tension she was induced to make a declaration abandoning her protest and promising to live on good terms with Austria. Her nationalist aspirations still continued, however, and were strengthened by her successes in the Balkan wars of 1912-13—successes which were compromised by Austria's opposition to her territorial expansion. As Servia grew, Austrian suspicion of her designs deepened.

(2.)

In the light of this history the storm of anti-Servian feeling which swept Austria-Hungary after the Sarajevo murders is easily understood. It was a feeling based on patriotism and loyalty. Europe was disposed to excuse its exaggerations and to sympathise with its motives.

But the dangers to European peace which it involved were immediately evident from the reports which reached the Government in London. Anti-Serb riots took place at Sarajevo and Agram. The members of the Serb party in the Provincial Council of Croatia were assailed by their colleagues with cries of "Servian assassins." Mobs in Vienna threatened the Servian Legation. The Austrian press, almost without exception, used the most unbridled language, and called for the condign punishment of Servia. There were signs

violent popular enthusiasm. They said themselves that they would be swept from power if they did not follow the popular desire for a conflict with Servia. Would this popular enthusiasm be content with any mere punitive expedition against the enemy? Surely not. Russia, therefore, openly said that she would have to intervene if Servia were attacked; but she promised Austria on the 27th that she would use all her influence at Belgrade to induce the Servian Government to give satisfaction to Austria, and only asked Austria to delay hostilities in order to give time for deliberation. Austria refused, saying it was too late. She declared war on Servia on the 28th. Russia ordered a partial mobilisation on the 29th.

But meanwhile Sir Edward Grey had proposed that the German, Italian, and French Ambassadors should meet him in London, to discuss the best means towards a settlement. Italy and France at once accepted; Russia said she was ready to stand aside; but Germany refused. She did not like what she called "a court of arbitration," and proposed instead direct negotiations between Russia and Austria. These negotiations actually began, as we have seen in the last paragraph, but they were cut short by the Austrian declaration of war against Servia. Austria then apparently considered that the moment for such negotiations was passed. She had, moreover, refused to discuss the Servian reply in any way, and it was difficult to see, after that refusal, what Russia could negotiate with her about. Russia, therefore, fell back on Sir E. Grey's proposal for a conference of Ambassadors in London, which she had originally expressed her readiness to accept. The Russian Minister for Foreign Affairs urged Sir E. Grey to induce Germany to indicate in what way she would consent to work for a settlement.

This brings the narrative of events down to Wednesday, the 29th July. Russia was mobilising partially in her southern provinces. Austrian troops were bombarding Belgrade. But, on the other hand, better news was coming from Berlin. Up to the 28th at least, both Germany and Austria had seemed unwilling to admit that the situation was really serious; Russia, it was said, was unprepared, and France was in no condition to go to war. Germany had said, in reply to Sir E. Grey's repeated advances, that she did not like to make representations to Vienna for fear of stiffening Austria's attitude. But on the evening of the 28th the German Chancellor assured the British Ambassador that he was trying to mediate at Vienna and St. Petersburgh. On the strength of this assurance and similar assurances made by the German Ambassador in London on the 29th, Sir E. Grey telegraphed to Berlin once more, in accordance with the request of the Russian Government, urging the German Government, if they did not like the idea of the Ambassadors' conference in the form he had suggested it, to suggest any other form they pleased. "Mediation," he said, "was ready to come into operation by any method that Germany thought possible if only Germany would press the button in the interests of peace." The telegram was despatched at about 4 o'clock on the evening of the 29th.

(6.)

This appeal was followed almost immediately by a strange response. About midnight, a telegram arrived at the Foreign Office from His Majesty's Ambassador at Berlin. The German Chancellor had sent for him late at night. He had asked if Great Britain would promise to remain neutral in a war, provided Germany did not touch Holland and took nothing from France but her colonies. He refused to give any undertaking that Germany would not invade Belgium, but he promised that, if Belgium remained passive, no territory would be taken from her.

Sir E. Grey's answer was a peremptory refusal, but he added an exhortation and an offer. The business of Europe was to work for peace. That was the only question with which Great Britain was concerned. If Germany would prove by her actions now that she desired peace, Great Britain would warmly welcome a future agreement with her whereby the whole weight of the two nations would be thrown permanently into the scale of peace in years to come.

For the next two days peace proposals and negotiations continued, some initiated and all supported by Great Britain. There remained a spark of hope. But from the British point of view the face of Europe henceforward was changed. On the 29th July the only conflict in progress had been on the frontiers of Servia and Austria; the only fear of further war had lain in the

relations of Russia and Austria. Germany's declarations were pacific; Russia had said she desired nothing but a period of peace to allow for her internal development; France would not fight except to help her ally. There had seemed no insuperable difficulty in keeping the peace; it was only a question of allaying the mutual suspicion between Vienna and St. Petersburgh. But now a new element of danger had been introduced. Great Britain now knew that Germany was contemplating an attack on France. She knew more. The independence of the Low Countries had for centuries been considered as one of the strongest means of securing the peace of Europe. Their position and the nature of the country rendered them the natural battlefield of Northern Europe. If it was made impossible for a Great Power to invade them, war would become increasingly difficult and dangerous. With the growth of the idea of a fixed system of international law founded on treaties, the neutrality of Belgium had been devised as a permanent safeguard to this end. As such, it had been consecrated by two international treaties signed by all the Powers, and recognised by two generations of statesmen. Now, when the peace of Europe was our one object, it was found that Germany was preparing to tear out the main rivet of that peace.

Germany's position must be understood. She had fulfilled her treaty obligations in the past; her action now was not wanton. Belgium was of supreme military importance in a war with France; if such a war occurred, it would be one of life and death; Germany feared that, if she did not occupy Belgium, France might do so. In face of this suspicion, there was only one thing to do. The neutrality of Belgium had not been devised as a pretext for wars, but to prevent the outbreak of wars. The Powers must reaffirm Belgian neutrality in order to prevent the war now threatened. The British Government, therefore, on Friday, the 31st July, asked the German and French Governments for an engagement to respect Belgium's neutrality, and the Belgian Government for an engagement to uphold it. France gave the necessary engagement the same day; Belgium gave it the day after; Germany returned no reply. Henceforward there could be no doubt of German designs.

Meanwhile, on the 30th and 31st negotiations continued between Russia and Austria. On the 29th Germany had suggested to Austria that she should stop as soon as her troops had occupied Belgrade. Late on the same night Russia offered to stop all military preparations, if Austria would recognise that the conflict with Servia had become a question of general European interest, and would eliminate from her ultimatum the points which involved a violation of the sovereignty of Servia. As the result of this offer, Russia was able to inform His Majesty's Government on the 31st that Austria had at last agreed to do the very thing she had refused to do in the first days of the crisis, namely, to discuss the whole question of her ultimatum to Servia. Russia asked the British Government to assume the direction of these discussions. For a few hours there seemed to be a hope of peace.

(7.)

At this moment, on Friday, the 31st, Germany suddenly despatched an ultimatum to Russia, demanding that she should countermand her mobilisation within twelve hours. Every allowance must be made for the natural nervousness which, as history has repeatedly shown, overtakes nations when mobilisation is under way. All that can be said is that, according to the information in the possession of His Majesty's Government, mobilisation had not at the time proceeded as far in Russia as in Germany, although general mobilisation was not publicly proclaimed in Germany till the next day, the 1st August. France also began to mobilise on that day. The German Secretary of State refused to discuss a last proposal from Sir E. Grey for joint action with Germany, France, and Italy until Russia's reply should be received, and in the afternoon the German Ambassador at St. Petersburgh presented a declaration of war. Yet on this same day, Saturday, the 1st, Russia assured Great Britain that she would on no account commence hostilities if the Germans did not cross the frontier, and France declared that her troops would be kept 6 miles from her frontier so as to prevent a collision. This was the situation when very early on Sunday morning, the 2nd August, German troops invaded Luxemburg, a small independent State whose neutrality had been guaranteed by all the Powers

with the same object as the similar guarantee of Belgium. The die was cast. War between Germany, Russia, and France had become inevitable.

Only one question now remained for this country. His Majesty's Government failed in their attempts to secure a general peace. Should they now remain neutral? The grounds on which that question was decided are clearly set forth in the statements of Sir E. Grey and Mr. Asquith in Parliament, which are contained in this volume,* and no additional explanations are needed here. But one fact may be emphasised. From the 24th July, when Russia first asked for British support, to the 2nd August, when a conditional promise of naval assistance was given to France, Sir E. Grey had consistently declined to give any promise of support to either of our present allies. He maintained that the position of Great Britain was that of a disinterested party whose influence for peace at Berlin and Vienna would be enhanced by the knowledge that we were not committed absolutely to either side in the existing dispute. He refused to believe that the best road to European peace lay through a show of force. We took no mobilisation measures except to keep our fleet assembled, and we confined ourselves to indicating clearly to Austria on the 27th July, and to Germany on the 29th July, that we could not engage to remain neutral if a European conflagration took place. We gave no pledge to our present allies, but to Germany we gave three times—on the 30th July, the 31st July, and the 1st August—a clear warning of the effect which would be produced on our attitude and on the sentiment of the British people by a violation of the neutrality of Belgium.

After Germany's declaration of war on Russia on the afternoon of the 1st, the Tsar telegraphed to His Majesty the King as follows: "In this solemn hour I wish to assure you once more that I have done all in my power to avert war." It is right to say that His Majesty's Government believe this to be a true statement of the attitude both of Russia and France throughout this crisis. On the other hand, with every wish to be fair and just, it will be admitted that the response of Germany and Austria gave no evidence of a sincere desire to save the peace of Europe.

Foreign Office, Sept. 28, 1914.

* *See* Part II.

LIST OF PRINCIPAL PERSONS MENTIONED IN THE CORRESPONDENCE, SHOWING THEIR OFFICIAL POSITIONS.

GREAT BRITAIN.

Secretary of State for Foreign Affairs ...	Sir Edward Grey.
Permanent Under Secretary of State for Foreign Affairs	Sir A. Nicolson.
French Ambassador	Monsieur Paul Cambon.
Russian Ambassador	Count Benckendorff.
	Monsieur de Etter (*Counsellor of Embassy*).
German Ambassador	Prince Lichnowsky.
Austro-Hungarian Ambassador	Count Mensdorff.
Belgian Minister	Count Lalaing.
Servian Minister	Monsieur Boschkovitch.

FRANCE.

President of the Republic	Monsieur Poincaré.
President of the Council and Minister for Foreign Affairs	Monsieur Viviani.
Minister of Justice and Acting Minister for Foreign Affairs	Monsieur Bienvenu-Martin.
British Ambassador	Sir Francis Bertie.
Russian Ambassador	Monsieur Isvolsky.
German Ambassador	Baron von Schoen.
Austrian Ambassador...	Count Scézsen.

RUSSIA.

Minister for Foreign Affairs	Monsieur Sazonof.
British Ambassador	Sir George Buchanan.
French Ambassador	Monsieur Paléologue.
German Ambassador	Count Pourtalès.
Austro-Hungarian Ambassador	Count Szápáry.

GERMANY.

Imperial Chancellor	Dr. von Bethmann-Hollweg.
Secretary of State	Herr von Jagow.
Under Secretary of State	Herr von Zimmermann.
British Ambassador	Sir Edward Goschen.
	Sir Horace Rumbold (*Counsellor of Embassy*).
Russian Ambassador	Monsieur Swerbeiev.
French Ambassador	Monsieur Jules Cambon.
Austro-Hungarian Ambassador	Count Szogyény.

AUSTRIA-HUNGARY.

Secretary of State for Foreign Affairs ...	Count Berchtold.
Under Secretaries of State for Foreign Affairs	Baron Macchio. Count Forgach
British Ambassador	Sir Maurice de Bunsen.
French Ambassador	Monsieur Dumaine.
Russian Ambassador	Monsieur Schebeko.
German Ambassador	Herr von Tschirscky.

ITALY.

Minister for Foreign Affairs...	Marquis di San Giuliano.
British Ambassador	Sir Rennell Rodd.

BELGIUM.

British Minister	Sir Francis Villiers.

SERVIA.

Prime Minister	Monsieur Pashitch.
British Minister	Mr. des Graz.
	Mr. Crackanthorpe (*First Secretary*).
Austro-Hungarian Minister	Baron Giesl.

No. 71.

Sir E. Goschen, British Ambassador at Berlin, to Sir Edward Grey.—(Received July 29.)

(Telegraphic.) *Berlin, July* 28, 1914.

AT invitation of Imperial Chancellor, I called upon his Excellency this evening. He said that he wished me to tell you that he was most anxious that Germany should work together with England for maintenance of general peace, as they had done successfully in the last European crisis. He had not been able to accept your proposal for a conference of representatives of the Great Powers, because he did not think that it would be effective, and because such a conference would in his opinion have had appearance of an "Areopagus" consisting of two Powers of each group sitting in judgment upon the two remaining Powers; but his inability to accept the proposed conference must not be regarded as militating against his strong desire for effective co-operation. You could be assured that he was doing his very best both at Vienna and St. Petersburgh to get the two Governments to discuss the situation directly with each other and in a friendly way. He had great hopes that such discussions would take place and lead to a satisfactory result, but if the news were true which he had just read in the papers, that Russia had mobilised fourteen army corps in the south, he thought situation was very serious, and he himself would be in a very difficult position, as in these circumstances it would be out of his power to continue to preach moderation at Vienna. He added that Austria, who as yet was only partially mobilising, would have to take similar measures, and if war were to result, Russia would be entirely responsible. I ventured to say that if Austria refused to take any notice of Servian note, which, to my mind, gave way in nearly every point demanded by Austria, and which in any case offered a basis for discussion, surely a certain portion of responsibility would rest with her. His Excellency said that he did not wish to discuss Servian note, but that Austria's standpoint, and in this he agreed, was that her quarrel with Servia was a purely Austrian concern with which Russia had nothing to do. He reiterated his desire to co-operate with England and his intention to do his utmost to maintain general peace. "A war between the Great Powers must be avoided" were his last words.

Austrian colleague said to me to-day that a general war was most unlikely, as Russia neither wanted nor was in a position to make war. I think that that opinion is shared by many people here.

No. 72.

Sir G. Buchanan, British Ambassador at St. Petersburgh, to Sir Edward Grey.—(Received July 29.)

(Telegraphic.) *St. Petersburgh, July* 28, 1914.

MINISTER for Foreign Affairs begged me to thank you for the language you had held to the German Ambassador, as reported in your telegram* to Berlin, substance of which I communicated to his Excellency. He took a pessimistic view of the situation, having received the same disquieting news from Vienna as had reached His Majesty's Government. I said it was important that we should know the real intentions of the Imperial Government, and asked him whether he would be satisfied with the assurances which the Austrian Ambassador had, I understood, been instructed to give in respect of Servia's integrity and independence. I added that I was sure any arrangement for averting a European war would be welcomed by His Majesty's Government. In reply his Excellency stated that if Servia were attacked Russia would not be satisfied with any engagement which Austria might take on these two points, and that order for mobilisation against Austria would be issued on the day that Austria crossed Servian frontier.

I told the German Ambassador, who appealed to me to give moderating counsels to the Minister for Foreign Affairs, that from the beginning I had not ceased to do so, and that the German Ambassador at Vienna should now in his turn use his restraining influence. I made it clear to his Excellency that, Russia being thoroughly in earnest, a general war could not be averted if Servia were attacked by Austria.

* See No. 46.

No. 94.

Sir M de Bunsen, British Ambassador at Vienna, to Sir Edward Grey.—(Received July 30.)

(Telegraphic.) *Vienna, July* 29, 1914.

I LEARN that mobilisation of Russian corps destined to carry out operations on Austrian frontier has been ordered. My informant is Russian Ambassador. Ministry for Foreign Affairs here has realised, though somewhat late in the day, that Russia will not remain indifferent in present crisis. I believe that the news of Russian mobilisation will not be a surprise to the Ministry, but so far it is not generally known in Vienna this evening. Unless mediation, which German Government declared themselves ready to offer in concert with three other Great Powers not immediately interested in the Austro-Servian dispute, be brought to bear forthwith, irrevocable steps may be taken in present temper of this country. German Ambassador feigns surprise that Servian affairs should be of such interest to Russia. Both my Russian and French colleagues have spoken to him to-day. Russian Ambassador expressed the hope that it might still be possible to arrange matters, and explained that it was impossible for Russia to do otherwise than take an interest in the present dispute. Russia, he said, had done what she could already at Belgrade to induce Servian Government to meet principal Austrian demands in a favourable spirit; if approached in a proper manner, he thought she would probably go still further in this direction. But she was justly offended at having been completely ignored, and she could not consent to be excluded from the settlement. German Ambassador said that if proposals were put forward which opened any prospect of possible acceptance by both sides, he personally thought that Germany might consent to act as mediator in concert with the three other Powers.

I gather from what Russian Ambassador said to me that he is much afraid of the effect that any serious engagement may have upon Russian public opinion. I gathered, however, that Russia would go a long way to meet Austrian demands on Servia.

No. 95.

Sir M. de Bunsen, British Ambassador at Vienna, to Sir Edward Grey.—(Received July 30.)

(Telegraphic.) *Vienna, July* 30, 1914.

RUSSIAN Ambassador hopes that Russian mobilisation will be regarded by Austria as what it is, viz., a clear intimation that Russia must be consulted regarding the fate of Servia, but he does not know how the Austrian Government are taking it. He says that Russia must have an assurance that Servia will not be crushed, but she would understand that Austria-Hungary is compelled to exact from Servia measures which will secure her Slav provinces from the continuance of hostile propaganda from Servian territory.

The French Ambassador hears from Berlin that the German Ambassador at Vienna is instructed to speak seriously to the Austro-Hungarian Government against acting in a manner calculated to provoke a European war.

Unfortunately the German Ambassador is himself so identified with extreme anti-Russian and anti-Servian feeling prevalent in Vienna that he is unlikely to plead the cause of peace with entire sincerity.

Although I am not able to verify it, I have private information that the German Ambassador knew the text of the Austrian ultimatum to Servia before it was despatched and telegraphed it to the German Emperor. I know from the German Ambassador himself that he endorses every line of it.

No. 96.

Sir M. de Bunsen, British Ambassador at Vienna, to Sir Edward Grey.—(Received July 30.)

(Telegraphic.) *Vienna, July* 30, 1914.

THE Russian Ambassador gave the French Ambassador and myself this afternoon at the French Embassy, where I happened to be, an account of his

interview with the Minister for Foreign Affairs, which he said was quite friendly. The Minister for Foreign Affairs had told him that as Russia had mobilised, Austria must, of course, do the same. This, however, should not be regarded as a threat, but merely as the adoption of military precautions similar to those which had been taken across the frontier. He said he had no objection to the Russian Minister for Foreign Affairs and the Austrian Ambassador at St. Petersburgh continuing their conversations, although he did not say that they could be resumed on the basis of the Servian reply.

On the whole, the Russian Ambassador is not dissatisfied. He had begun to make his preparations for his departure on the strength of a rumour that Austria would declare war in reply to mobilisation. He now hopes that something may yet be done to prevent war with Austria.

No. 97.

Sir G. Buchanan, British Ambassador at St. Petersburgh, to Sir Edward Grey.—(Received July 30.)

(Telegraphic.) *St. Petersburgh, July* 30, 1914.

FRENCH Ambassador and I visited Minister for Foreign Affairs this morning. His Excellency said that German Ambassador had told him yesterday afternoon that German Government were willing to guarantee that Servian integrity would be respected by Austria. To this he had replied that this might be so, but nevertheless Servia would become an Austrian vassal, just as, in similar circumstances, Bokhara had become a Russian vassal. There would be a revolution in Russia if she were to tolerate such a state of affairs.

M. Sazonof* told us that absolute proof was in possession of Russian Government that Germany was making military and naval preparations against Russia—more particularly in the direction of the Gulf of Finland.

German Ambassador had a second interview with Minister for Foreign Affairs at 2 A.M., when former completely broke down on seeing that war was inevitable. He appealed to M. Sazonof* to make some suggestion which he could telegraph to German Government as a last hope. M. Sazonof* accordingly drew up and handed to German Ambassador a formula in French, of which following is translation:—

"If Austria, recognising that her conflict with Servia has assumed character of question of European interest, declares herself ready to eliminate from her ultimatum points which violate principle of sovereignty of Servia, Russia engages to stop all military preparations."

Preparations for general mobilisation will be proceeded with if this proposal is rejected by Austria, and inevitable result will be a European war. Excitement here has reached such a pitch that, if Austria refuses to make a concession, Russia cannot hold back, and now that she knows that Germany is arming, she can hardly postpone, for strategical reasons, converting partial into general mobilisation.

* Russian Minister for Foreign Affairs.

No. 98.

Sir E. Goschen, British Ambassador at Berlin, to Sir Edward Grey.—(Received July 30.)

(Telegraphic.) *Berlin, July* 30, 1914.

SECRETARY of State informs me that immediately on receipt of Prince Lichnowsky's* telegram recording his last conversation with you he asked Austro-Hungarian Government whether they would be willing to accept mediation on basis of occupation by Austrian troops of Belgrade or some other point and issue their conditions from here. He has up till now received no reply, but he fears Russian mobilisation against Austria will have increased difficulties, as Austria-Hungary, who has as yet only mobilised against Servia, will probably find it necessary also against Russia. Secretary of State says if you can succeed in getting Russia to agree to above basis for an arrangement and in persuading her in the meantime to take no steps which might be regarded as an act of

* German Ambassador in London.

No. 101.

Sir Edward Grey to Sir E. Goschen, British Ambassador at Berlin.

(Telegraphic.) *Foreign Office, July* 30, 1914.

YOUR telegram of 29th July.*

His Majesty's Government cannot for a moment entertain the Chancellor's proposal that they should bind themselves to neutrality on such terms.

What he asks us in effect is to engage to stand by while French colonies are taken and France is beaten so long as Germany does not take French territory as distinct from the colonies.

From the material point of view such a proposal is unacceptable, for France, without further territory in Europe being taken from her, could be so crushed as to lose her position as a Great Power, and become subordinate to German policy.

Altogether apart from that, it would be a disgrace for us to make this bargain with Germany at the expense of France, a disgrace from which the good name of this country would never recover.

The Chancellor also in effect asks us to bargain away whatever obligation or interest we have as regards the neutrality of Belgium. We could not entertain that bargain either.

Having said so much it is unnecessary to examine whether the prospect of a future general neutrality agreement between England and Germany offered positive advantages sufficient to compensate us for tying our hands now. We must preserve our full freedom to act as circumstances may seem to us to require in any such unfavourable and regrettable development of the present crisis as the Chancellor contemplates.

You should speak to the Chancellor in the above sense, and add most earnestly that the one way of maintaining the good relations between England and Germany is that they should continue to work together to preserve the peace of Europe; if we succeed in this object, the mutual relations of Germany and England will, I believe, be *ipso facto* improved and strengthened. For that object His Majesty's Government will work in that way with all sincerity and good-will.

And I will say this: If the peace of Europe can be preserved, and the present crisis safely passed, my own endeavour will be to promote some arrangement to which Germany could be a party, by which she could be assured that no aggressive or hostile policy would be pursued against her or her allies by France, Russia, and ourselves, jointly or separately. I have desired this and worked for it, as far as I could, through the last Balkan crisis, and, Germany having a corresponding object, our relations sensibly improved. The idea has hitherto been too Utopian to form the subject of definite proposals, but if this present crisis, so much more acute than any that Europe has gone through for generations, be safely passed, I am hopeful that the relief and reaction which will follow may make possible some more definite rapprochement between the Powers than has been possible hitherto.

* See No. 85.

No. 102.

Sir Edward Grey to Sir E. Goschen, British Ambassador at Berlin.

(Telegraphic.) *Foreign Office, July* 30, 1914.

I HAVE warned Prince Lichnowsky* that Germany must not count upon our standing aside in all circumstances. This is doubtless the substance of the telegram from Prince Lichnowsky* to German Chancellor, to which reference is made in the last two paragraphs of your telegram of 30th July.†

* German Ambassador in London. † See No. 98.

No. 103.

Sir Edward Grey to Sir G. Buchanan, British Ambassador at St. Petersburgh.

(Telegraphic.) *Foreign Office, July* 30, 1914.

GERMAN Ambassador informs me that German Government would endeavour to influence Austria, after taking Belgrade and Servian territory in region of frontier, to promise not to advance further, while Powers endeavoured

to arrange that Servia should give satisfaction sufficient to pacify Austria. Territory occupied would of course be evacuated when Austria was satisfied. I suggested this yesterday as a possible relief to the situation, and, if it can be obtained, I would earnestly hope that it might be agreed to suspend further military preparations on all sides.

Russian Ambassador has told me of condition laid down by M. Sazonof,* as quoted in your telegram of the 30th July,† and fears it cannot be modified; but if Austrian advance were stopped after occupation of Belgrade, I think Russian Minister for Foreign Affairs' formula might be changed to read that the Powers would examine how Servia could fully satisfy Austria without impairing Servian sovereign rights or independence.

If Austria, having occupied Belgrade and neighbouring Servian territory, declares herself ready, in the interest of European peace, to cease her advance and to discuss how a complete settlement can be arrived at, I hope that Russia would also consent to discussion and suspension of further military preparations, provided that other Powers did the same.

It is a slender chance of preserving peace, but the only one I can suggest if Russian Minister for Foreign Affairs can come to no agreement at Berlin. You should inform Minister for Foreign Affairs.

* Russian Minister for Foreign Affairs. † See No. 97.

No. 104.

Sir Edward Grey to Sir F. Bertie, British Ambassador at Paris.

(Telegraphic.) *Foreign Office, July* 30, 1914.

YOU should inform the Minister for Foreign Affairs of my telegram to Sir G. Buchanan* of to-day,† and say that I know that he has been urging Russia not to precipitate a crisis. I hope he may be able to support this last suggestion at St. Petersburgh.

* British Ambassador at St. Petersburgh. † See No. 103.

No. 105.

Sir Edward Grey to Sir F. Bertie, British Ambassador at Paris.

Sir, *Foreign Office, July* 30, 1914.

M. CAMBON* reminded me to-day of the letter I had written to him two years ago, in which we agreed that, if the peace of Europe was seriously threatened, we would discuss what we were prepared to do. I enclose for convenience of reference copies of the letter in question and of M. Cambon's reply. He said that the peace of Europe was never more seriously threatened than it was now. He did not wish to ask me to say directly that we would intervene, but he would like me to say what we should do if certain circumstances arose. The particular hypothesis he had in mind was an aggression by Germany on France. He gave me a paper, of which a copy is also enclosed, showing that the German military preparations were more advanced and more on the offensive upon the frontier than anything France had yet done. He anticipated that the aggression would take the form of either a demand that France should cease her preparations, or a demand that she should engage to remain neutral if there was war between Germany and Russia. Neither of these things could France admit.

I said that the Cabinet was to meet to-morrow morning, and I would see him again to-morrow afternoon.

I am, &c.,
E. GREY.

* French Ambassador in London.

Enclosure 1 in No. 105.

Sir Edward Grey to M. Cambon, French Ambassador in London.

My dear Ambassador, *Foreign Office, November* 22, 1912.

FROM time to time in recent years the French and British naval and military experts have consulted together. It has always been understood

No. 118.

Sir M. de Bunsen, British Ambassador at Vienna, to Sir Edward Grey.—(Received July 31.)

(Telegraphic.) *Vienna, July* 31, 1914.

I AM informed by Count Forgach, Under-Secretary of State, that although Austria was compelled to respond to Russian mobilisation, which he deplored, the Austrian Ambassador in London has received instructions to inform you that mobilisation was not to be regarded as a necessarily hostile act on either side. Telegrams were being exchanged between the Emperor of Russia and the German Emperor, and conversations were proceeding between Austrian Ambassador at St. Petersburgh and Russian Minister for Foreign Affairs. A general war might, he seriously hoped, be staved off by these efforts. On my expressing my fear that Germany would mobilise, he said that Germany must do something, in his opinion, to secure her position. As regards Russian intervention on behalf of Servia, Austria-Hungary found it difficult to recognise such a claim. I called his attention to the fact that during the discussion of the Albanian frontier at the London Conference of Ambassadors the Russian Government had stood behind Servia, and that a compromise between the views of Russia and Austria-Hungary resulted with accepted frontier line. Although he spoke in a conciliatory tone, and did not regard the situation as desperate, I could not get from him any suggestion for a similar compromise in the present case. Count Forgach is going this afternoon to see the Russian Ambassador, whom I have informed of the above conversation.

The Russian Ambassador has explained that Russia has no desire to interfere unduly with Servia; that, as compared with the late Russian Minister, the present Minister at Belgrade is a man of very moderate views; and that, as regards Austrian demands, Russia had counselled Servia to yield to them as far as she possibly could without sacrificing her independence. His Excellency is exerting himself strongly in the interests of peace.

GREY'S DOUBLETALKING OBFUSCATION (DOUBLE NEGATIVES!)

No. 119.

Sir Edward Grey to Sir F. Bertie, British Ambassador at Paris.

Sir, *Foreign Office, July* 31, 1914.

M. CAMBON* referred to-day to a telegram that had been shown to Sir Arthur Nicolson† this morning from the French Ambassador in Berlin, saying that it was the uncertainty with regard to whether we would intervene which was the encouraging element in Berlin, and that, if we would only declare definitely on the side of Russia and France, it would decide the German attitude in favour of peace.

I said that it was quite wrong to suppose that we had left Germany under the impression that we would not intervene. I had refused overtures to promise that we should remain neutral. I had not only definitely declined to say that we would remain neutral, I had even gone so far this morning as to say to the German Ambassador that, if France and Germany became involved in war, we should be drawn into it. That, of course, was not the same thing as taking an engagement to France, and I told M. Cambon of it only to show that we had not left Germany under the impression that we would stand aside.

M. Cambon then asked me for my reply to what he had said yesterday.

I said that we had come to the conclusion, in the Cabinet to-day, that we could not give any pledge at the present time. Though we should have to put our policy before Parliament, we could not pledge Parliament in advance. Up to the present moment, we did not feel, and public opinion did not feel, that any treaties or obligations of this country were involved. Further developments might alter this situation and cause the Government and Parliament to take the view that intervention was justified. The preservation of the neutrality of Belgium might be, I would not say a decisive, but an important factor, in determining our attitude. Whether we proposed to Parliament to intervene or not to intervene in a war, Parliament would wish to know how we stood with regard to the neutrality of Belgium, and it might be that I should ask

* French Ambassador in London.

† British Under Secretary of State for Foreign Affairs.

both France and Germany whether each was prepared to undertake an engagement that she would not be the first to violate the neutrality of Belgium.

M. Cambon repeated his question whether we would help France if Germany made an attack on her.

I said that I could only adhere to the answer that, as far as things had gone at present, we could not take any engagement.

M. Cambon urged that Germany had from the beginning rejected proposals that might have made for peace. It could not be to England's interest that France should be crushed by Germany. We should then be in a very diminished position with regard to Germany. In 1870 we had made a great mistake in allowing an enormous increase of German strength, and we should now be repeating the mistake. He asked me whether I could not submit his question to the Cabinet again.

I said that the Cabinet would certainly be summoned as soon as there was some new development, but at the present moment the only answer I could give was that we could not undertake any definite engagement.

I am, &c.,

!!! E. GREY.

No. 120.

Sir G. Buchanan, British Ambassador at St. Petersburgh, to Sir Edward Grey.—(Received August 1.)

(Telegraphic.) *St. Petersburgh, July* 31, 1914.

MINISTER for Foreign Affairs sent for me and French Ambassador and asked us to telegraph to our respective Governments subjoined formula as best calculated to amalgamate proposal made by you in your telegram of 30th July* with formula recorded in my telegram of 30th July.† He trusted it would meet with your approval:—

"Si l'Autriche consentira à arrêter marche des ses troupes sur le territoire serbe, si, reconnaissant que le conflit austro-serbe a assumé le caractère d'une question d'intérêt européen, elle admet que les Grandes Puissances examinent la satisfaction que la Serbie pourrait accorder au Gouvernement d'Autriche-Hongrie sans laisser porter atteinte à ses droits d'État souverain et à son indépendance, la Russie s'engage à conserver son attitude expectante."‡

His Excellency then alluded to the telegram sent to German Emperor by Emperor of Russia in reply to the former's telegram. He said that Emperor Nicholas had begun by thanking Emperor William for his telegram and for the hopes of peaceful solution which it held out. His Majesty had then proceeded to assure Emperor William that no intention whatever of an aggressive character was concealed behind Russian military preparations. So long as conversation with Austria continued, His Imperial Majesty undertook that not a single man should be moved across the frontier; it was, however, of course impossible, for reasons explained, to stop a mobilisation which was already in progress.

M. Sazonof§ said that undoubtedly there would be better prospect of a peaceful solution if the suggested conversation were to take place in London, where the atmosphere was far more favourable, and he therefore hoped that you would see your way to agreeing to this.

His Excellency ended by expressing his deep gratitude to His Majesty's Government, who had done so much to save the situation. It would be largely due to them if war were prevented. The Emperor, the Russian Government, and the Russian people would never forget the firm attitude adopted by Great Britain.

* See No. 103. † See No. 97.

‡ TRANSLATION.—"If Austria will agree to check the advance of her troops on Servian territory; if, recognising that the dispute between Austria and Servia has assumed a character of European interest, she will allow the Great Powers to look into the matter and determine whether Servia could satisfy the Austro-Hungarian Government without impairing her rights as a sovereign State or her independence, Russia will undertake to maintain her waiting attitude."

§ Russian Minister for Foreign Affairs.

No. 123.

Sir Edward Grey to Sir E. Goschen, British Ambassador at Berlin.

Sir,

Foreign Office, August 1, 1914.

I TOLD the German Ambassador to-day that the reply* of the German Government with regard to the neutrality of Belgium was a matter of very

* See No. 122.

great regret, because the neutrality of Belgium affected feeling in this country. If Germany could see her way to give the same assurance as that which had been given by France it would materially contribute to relieve anxiety and tension here. On the other hand, if there were a violation of the neutrality of Belgium by one combatant while the other respected it, it would be extremely difficult to restrain public feeling in this country. I said that we had been discussing this question at a Cabinet meeting, and as I was authorised to tell him this I gave him a memorandum of it.

He asked me whether, if Germany gave a promise not to violate Belgium neutrality we would engage to remain neutral.

I replied that I could not say that; our hands were still free, and we were considering what our attitude should be. All I could say was that our attitude would be determined largely by public opinion here, and that the neutrality of Belgium would appeal very strongly to public opinion here. I did not think that we could give a promise of neutrality on that condition alone.

The Ambassador pressed me as to whether I could not formulate conditions on which we would remain neutral. He even suggested that the integrity of France and her colonies might be guaranteed.

I said that I felt obliged to refuse definitely any promise to remain neutral on similar terms, and I could only say that we must keep our hands free.

I am, &c.,

E. GREY.

No. 124.

Sir F. Bertie, British Ambassador at Paris, to Sir Edward Grey.—(Received August 1.)

(Telegraphic.)

Paris, July 31, 1914.

ON the receipt at 8.30 to-night of your telegram of this afternoon,* I sent a message to Minister for Foreign Affairs requesting to see him. He received me at 10.30 to-night at the Elysée, where a Cabinet Council was being held. He took a note of the enquiry as to the respecting by France of the neutrality of Belgium which you instructed me to make.

He told me that a communication had been made to you by the German Ambassador in London of the intention of Germany to order a general mobilisation of her army if Russia do not demobilise at once. He is urgently anxious as to what the attitude of England will be in the circumstances, and begs that an answer may be made by His Majesty's Government at the earliest moment possible.

Minister for Foreign Affairs also told me that the German Embassy is packing up.

* See No. 114.

upon the Italian declaration that the present war was not a defensive but an aggressive war, and that, for this reason, the *casus fœderis* under the terms of the Triple Alliance did not arise.

I am, &c.
E. GREY.

No. 153.

Sir Edward Grey to Sir E. Goschen, British Ambassador at Berlin.

(Telegraphic.) *Foreign Office, August* 4, 1914.

THE King of the Belgians has made an appeal to His Majesty the King for diplomatic intervention on behalf of Belgium in the following terms:—

"Remembering the numerous proofs of your Majesty's friendship and that of your predecessor, and the friendly attitude of England in 1870 and the proof of friendship you have just given us again, I make a supreme appeal to the diplomatic intervention of your Majesty's Government to safeguard the integrity of Belgium."

His Majesty's Government are also informed that the German Government have delivered to the Belgian Government a note proposing friendly neutrality entailing free passage through Belgian territory, and promising to maintain the independence and integrity of the kingdom and its possessions at the conclusion of peace, threatening in case of refusal to treat Belgium as an enemy. An answer was requested within twelve hours.

We also understand that Belgium has categorically refused this as a flagrant violation of the law of nations.

His Majesty's Government are bound to protest against this violation of a treaty to which Germany is a party in common with themselves, and must request an assurance that the demand made upon Belgium will not be proceeded with and that her neutrality will be respected by Germany. You should ask for an immediate reply.

No. 154.

Sir F. Villiers, British Minister at Brussels, to Sir Edward Grey.—
(Received August 4.)

(Telegraphic.) *Brussels, August* 4, 1914.

GERMAN Minister has this morning addressed note to Minister for Foreign Affairs stating that as Belgian Government have declined the well-intentioned proposals submitted to them by the Imperial Government, the latter will, deeply to their regret, be compelled to carry out, if necessary by force of arms, the measures considered indispensable in view of the French menaces.

VITAL No. 155.

Sir Edward Grey to Sir F. Villiers, British Minister at Brussels.

(Telegraphic.) *Foreign Office, August* 4, 1914.

YOU should inform Belgian Government that if pressure is applied to them by Germany to induce them to depart from neutrality, His Majesty's Government expect that they will resist by any means in their power, and that His Majesty's Government will support them in offering such resistance, and that His Majesty's Government in this event are prepared to join Russia and France, if desired, in offering to the Belgian Government at once common action for the purpose of resisting use of force by Germany against them, and a guarantee to maintain their independence and integrity in future years.

No. 156.

Sir Edward Grey to Sir E. Goschen, British Ambassador at Berlin.

(Telegraphic.) *Foreign Office, August* 4, 1914.

I CONTINUE to receive numerous complaints from British firms as to the detention of their ships at Hamburg, Cuxhaven, and other German ports. This

WELFARE SECTION

AFTER a hydrogen bomb attack, thousands would be homeless, hungry, exhausted and frightened. Help and comfort would come from the Welfare Section. Its members are training now for such tasks as evacuation and reception, emergency feeding, and running rest centres, information centres and mobile canteens.

An Emergency Feeding Unit with an improvised hot-plate cooker.

CIVIL DEFENCE CORPS.

10. The Welfare Section are trained to look after the homeless, organise and escort parties of evacuated children. They also run information centres.

Prepared by Dr. William Chipman DCPA

July 13, 1979

(WRITTEN 2 DAYS BEFORE DCPA BECAME FEMA ON 15 JULY 1979)
Dr William Chipman

CIVIL DEFENSE FOR THE 1980's--CURRENT ISSUES

ABSTRACT:

Presidential Decision 41. PD 41 makes it clear that CD is a factor to be taken into account in assessing the strategic balance: The U.S. program is to "enhance deterrence and stability," and to "reduce the possibility that the Soviets could coerce us" in a crisis.

Civil Defense and the Cuban Crisis **PAGE 47**

There is a final point worth making with respect to civil defense and crises. In a 1978 interview, Steuart L. Pittman, who was Assistant Secretary of Defense for Civil Defense in 1961 to 1964, pointed out:

> [I]t is interesting that President Kennedy personally raised the civil defense question during the Cuban crisis. He was considering conventional military action against Cuba to knock out the missile sites. I understand he was the only one of the "Committee" to raise the issue of civil defense, which tells us something. He asked whether it would be practical to evacuate Miami and other coastal cities in Florida. . . . I was called into the marathon crisis meeting and had to tell him that it would not be practical; we did not have any significant evacuation plans. . . . The President dropped the idea, but shortly after the crisis was over, his personal concern over his limited civil defense options led him to sign a memorandum directing a significant speedup in the U.S. civil defense preparations. (Emphasis added.)93/

While history seldom repeats itself exactly, it does indeed "tell us something" that in the only overt nuclear confrontation the world has

93/Op. cit. supra note 73 at 152-153.

yet seen, the American President was concerned about civil defense--and that the idea of population relocation during the crisis was one of his specific concerns. Certainly it is clear that in 1962, the notion of vulnerability being stabilizing held little attraction for the Chief Executive. And as outlined below (in discussion of CD and SALT), the notion that vulnerability is desirable has never commended itself to Soviet leaders.

73/Sullivan, Roger J. et al, The Potential Effects of Crisis Relocation on Crisis Stability, System Planning Corporation, Arlington, Virginia, September 1978.

Richard Titmuss's classic study of civil defence in the Second World War, "Problems of Social Policy", 1950, made the case that the postwar social state originated in the wartime civil defence system to care for millions of bombing evacuees and families who lost their homes.

[See: John Welshman, "Evacuation and Social Policy ... ", Twentieth Century British History (1998) 9 (1): 28-53.]

NUMBER AND CLASSIFICATION OF OFFICIAL EVACUEES IN GREAT BRITAIN IN 1939 AND 1940

900,000 of the 1.5 million returned to the target areas after four months of war.	SEPTEMBER, 1939		JANUARY, 1940	
	Number	Percentage Distribution	Number	Per cent of Those in September, 1939
1. Unaccompanied school children......	826,959	56.1	457,600	55
2. Mothers and accompanied children...	523,670	35.5	64,900	12
3. Expectant mothers..................	12,705	0.9	1,140	9
4. Blind persons, cripples, and other special classes.........................	7,057	0.5	2,440	35
5. Teachers and helpers...............	103,000	7.0	46,500	45
Total.........................	1,473,391	100.0	572,580	39

Source: R. M. Titmuss, *Problems of Social Policy* (London: H.M. Stationery Office, 1950), pp. 103 and 172.

IMPORTANT ANNOUNCEMENT

DISPERSAL OF CIVILIAN POPULATION

....**COUNCIL**

The Government have announced that the voluntary dispersal of the following classes of persons from this area* to reception areas in other parts of the country shall be put into effect immediately.

1. CHILDREN UNDER 15
Children of this age must be taken by their mothers, or by another responsible adult if their mother cannot go. Only in most exceptional circumstances will children be allowed to go on their own. (EXAMPLE : if neither of their parents can go because of illness and there is no one else to take them.)

2. CHILDREN BETWEEN 15 AND 18 STILL AT SCHOOL FULL-TIME
Children in this class may either go with their mothers or on their own. In exceptional circumstances they may go with another responsible adult. (EXAMPLE : a handicapped child whose mother is too ill to go.)

3. CHILDREN BETWEEN 15 AND 18 WHO HAVE LEFT SCHOOL
Children in this class should go on their own. Only in exceptional circumstances may they be accompanied. (EXAMPLE : if they are handicapped, or if the mother is taking younger children.)

4. EXPECTANT MOTHERS

5. BLIND, CRIPPLED OR AGED AND INFIRM PEOPLE *only* if they are dependent on the care of a person who is a member of the classes mentioned above and who is travelling under the scheme.

Special arrangements are being made for the dispersal of children under the age of 18 who are resident at boarding schools, homes or other similar establishments. Parents who do not wish their children to take part in such arrangements should immediately contact the establishments.

Children in the care of a local authority who are living with fosterparents are included in the above classes. If their fosterparents are unable to go with them the Child Care Authority should be informed at once.

Anyone living in the area of..who comes within the above priority classes and wishes to take part in the scheme should go immediately to ....where they will be given further instructions.

CLERK OF THE COUNCIL

***If only part of the area is within the dispersal scheme, the districts affected are shown below:**

UK National Archives: HO 225/54 and CAB 21/4053

HOME OFFICE

SCIENTIFIC ADVISERS' BRANCH

The Circulation of this paper has been strictly limited. Mr Shatt

It is issued for the personal use of ......

SECRET

CD/SA 54

Copy No. 54

Some Aspects of Shelter and Evacuation Policy to meet H-Bomb threat

---

The simplest way of specifying shelter performance is by means of the "Safety Rating" concept developed in CD/SA 48. The safety rating of a shelter was there defined as the saving in life, expressed as a percentage of the deaths without shelter, resulting from the use of the shelter in an area of uniform population density. This shelter with a safety rating of 80 would save 80% of the lives that would have been lost if everyone had been in a house. Put in another way, shelter with a safety rating of 80 would reduce the area within which deaths occurred to one fifth of that for people in houses, and therefore the radius of death to $\frac{1}{\sqrt{5}}$. For a bomb with a power factor of F the equivalent radius of death if everyone is in a shelter with a safety rating of 80 will therefore be $\frac{0.6\sqrt[3]{F}}{\sqrt{5}}$. Similarly for shelter with a safety rating of 90 the radius will be $\frac{0.6\sqrt[3]{F}}{\sqrt{10}}$.

Although, as stated above, the design details of shelters to give these safety ratings have not been determined, it seems probable that surface or trench shelters of rather less than Grade A strength (say 1000 lb/sq.ft.) would be required to give a safety rating of 80, and that a strength of about 2000 lb/sq.ft. would be required for a safety rating of 90. For small street surface shelters the extra cost of an increase in strength of this sort is very small (e.g. the structural cost of a 12"/1000 lb/sq.ft. design is given in CD/SA 48 as £15.2 per person, based on seated capacity) and of a 12"/1400 lb/sq.ft design as £15.5 per person) and detailed studies may well show that shelters with a higher safety rating than 90 are a practical proposition.

(N = 20 kt)

Table 3

Deaths with no evacuation but with everyone in a shelter with a Safety Rating of 90

2 Mt 10 Mt 20 Mt

City	Power of bomb		
	100N	500N	1000N
London	59,000	216,000	367,000

The considerations discussed above strongly suggest that the right policy against the hydrogen bomb would be to evacuate the central areas of our larger cities and to provide shelter where it is most useful, i.e. in the annulus surrounding the central evacuation area.

CD/SA 48 = Nat. Archives HO 225/48

Table 4

Deaths from 1000N bombs after evacuation of 5 mile radius circle for London and 3 mile radius for other cities. Evacuees assumed accommodated in surrounding annulus where they and the original inhabitants are provided with shelter having a safety rating of 80.

20 Mt

City	Position of bomb		
	Central	2 miles from centre	In position to cause maximum deaths
London	0	0	518,000
Birmingham	0	159,000	256,000
Glasgow	0	171,000	247,000
Liverpool	0	174,000	247,000
Manchester	0	164,000	257,000
Total	0	668,000	1,525,000

Table 5

Deaths from 1000N bombs after evacuation of 5 mile radius circle for London and 3 mile radius for other cities. Evacuees assumed accommodated in surrounding annulus where they and the original inhabitants are provided with shelter with a safety rating of 90.

20 Mt

City	Position of bomb		
	Central	2 miles from centre	In position to cause maximum deaths
London	0	0	261,000
Birmingham	0	56,000	155,000
Glasgow	0	64,000	152,000
Liverpool	0	67,000	152,000
Manchester	0	62,000	151,000
Total	0	249,000	871,000

It will be seen from Tables 4 and 5 that, with this scheme of total evacuation of a central area and shelter in the surrounding annulus, a central bomb causes no deaths at all. Clearly, however, the enemy would be aware of our provisions and might well choose to drop his bombs where they would cause maximum casualties. On average, and without allowing for local concentrations which would be bound to occur in the "reception annulus", this would be at about 7 miles from the centre in the case of London and about 4 miles for the other cities. The average deaths from bombs in these worst positions are therefore given in Tables 4 and 5. Comparing these figures with those to Table 1 it will be seen that evacuation plus shelter with a safety rating of 80 has reduced deaths by 82%, and plus shelter with a safety rating of 90 by 90%.

Conclusion

Without shelter or evacuation, the deaths from an attack with only five hydrogen bombs might total over $8\frac{1}{2}$ million. The primary object of Civil Defence must be to reduce this figure. Neither evacuation alone nor shelter alone could reduce these deaths to a manageable proportion, but with a suitable combination of the two, consisting of the total evacuation of the population of the central areas into the surrounding annuli where shelter would be provided, it should be possible to reduce the maximum deaths from this particular attack to something of the order of one million.

April, 1954.

E.L.W. **E. L. W. = Edward Leader-Williams**

OSA.41/4/32. **(who in WWII tested the Morrison shelter while John Fleetwood Baker's colleague)**

REFERENCES:

CD/SA 48 = Nat. Archives HO 225/48, "The safety-cost relationship for certain types of surface and trench shelters"

CD/SA 72 = Nat. Archives HO 225/72, "Casualty estimates for ground burst 10 megaton bombs"

JOINT SERVICE MANUAL OF HOME DEFENCE

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CHAPTER INDEX

PART I - BACKGROUND TO HOME DEFENCE

CHAPTER 1

INTRODUCTION TO HOME DEFENCE

"The phoenix of mythology re-juvenated itself in flames, rising from its own ashes to a new life. The flames of a future war may, or may not be of our own creating and, in a nuclear conflict, will certainly be more than a little hot. The ultimate purpose of Home Defence is to ensure that we are able to rise phoenix-like from the ashes of a nuclear conflagration and that any lack of preparation does not result in the death of the bird - our nation."

SECTION 1. INTRODUCTION

NCE ACT 1948

FORMS OF ATTACK

123. The current assessments point clearly to nuclear was as the overriding consideration in determining the preparations to be made for home defence in the United Kingdom. Whilst it is possible that chemical weapons and, to a lesser extent biological warfare, could be used against selected vitally important civil and military installations, their use against the civil population as a whole is considered most unlikely. The use of aircraft and missiles armed with non-nuclear devices against selected targets cannot be discounted, but most of the measures taken in the context of a nuclear war would be of equal relevance to a war which began with conventional weapons.

EFFECTS OF ATTACK

124. As with the warning period, the scale and pattern of attack cannot be determined with precision but, whatever the scale, an attack by thermo-nuclear weapons directed against civil and military installati[ons] and against centres of population, with the attendant threat of widespre[ad] radioactive fall-out, would result in enormous casualties and extensive damage. Although estimates can be made of local casualties and of damage caused by varying attack patterns, no probability can be given to any one group of attack patterns. Nevertheless, solely for the purpose of survival planning, it can be assumed that the population survival rate would range from 60% in the worst affected areas to 95% in the least affected areas. On the other hand, loss of essential services and productive capacity due to installation damage, loss of power supplies and lack of raw materials, could be as high as 80%. These figures are merely indicative of the possible scale of the effe[cts] of nuclear war.

SECTION 1. INTRODUCTION

201. This chapter is not intended to be a comprehensive assessment of the threat to the United Kingdom. It merely sets the scene within which the subject of Home Defence can be studied. Those requiring a greater depth of knowledge must turn to available classified publicati A basic knowledge of the effects of nuclear explosions is assumed and can be obtained from pamphlets listed in the Bibliography (Annex C to the Manual).

202. The overall threat can be divided into the following:

a. Internal Threat - sabotage and subversion.

b. Conventional attack.

c. Nuclear attack.

d. Chemical attack.

e. Biological attack.

03. Current assessments point clearly to nuclear attack as th verriding consideration in determining the preparations to be ma r Home Defence in the United Kingdom and this must be accepted basic planning assumption. Planning to deal with the other f ... as they may form a prelude or part of a n

targets but also ... will and ... to tie down la
weaken the national will and ...

208. One result of sabotage would be to tie down la men on static guard duties thereby preventing them fro other necessary tasks.

SUBVERSION

209. There exist in this country certain dissider which are known to be in sympathy with our potential can be expected to react against the good of the nat tension. These groups are small and for the most p influence. Moreover, it is likely that their numbe enemy were seen to be about to attack us. However especially that of the IRA, should not be underesti

210. The threat posed by subversive groups inclu in key industries, promoting anti-war demonstration against the Government and disruptive activities co preparations.

SECTION 6 - INFORMATION TO THE PUBLIC IN WAR

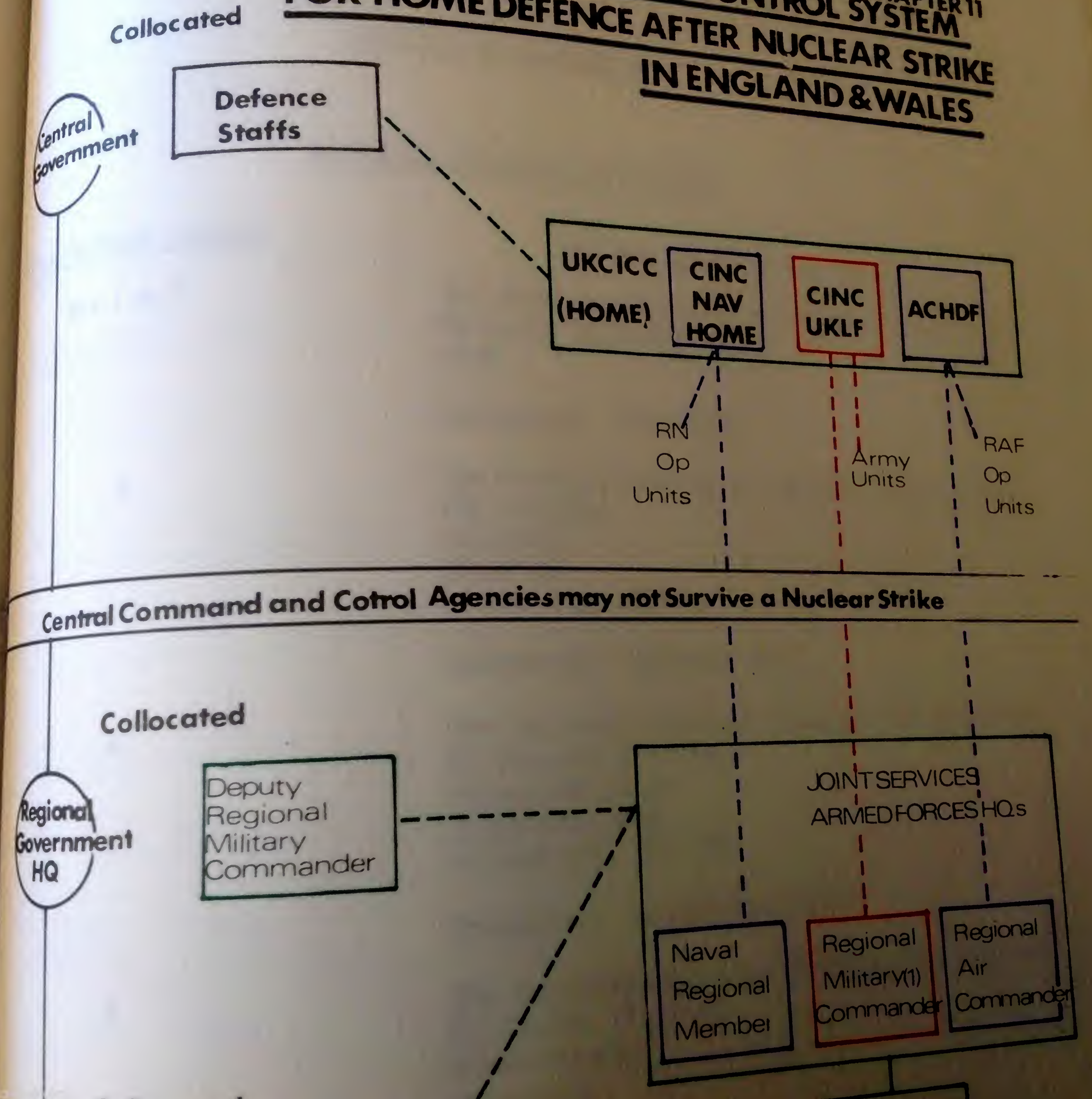
INTRODUCTION

1056. The question of what the public should be told and when is an extremely difficult one. Certain announcements can be prepared for issue in a period of tension and post strike. The timing of their issue cannot, however, be accurately pre-planned and will largely be a matter for decision in the event.

1057. The two conflicting issues in retaining the full cooperation of the public are firstly to avoid any sort of panic possibly leading to a mass movement of population and secondly to ensure that sufficient warning is given to allow necessary preventative and later survival action to be taken.

ANNEX B TO CHAPTER 11

JOINT SERVICE COMMAND & CONTROL SYSTEM FOR HOME DEFENCE AFTER NUCLEAR STRIKE IN ENGLAND & WALES



JIC(68) 4 (Final)

22nd January, 1968.

EMPLOYMENT OF SOVIET FORCES IN THE EVENT OF GENERAL WAR UP TO THE END OF 1972

Report by the Joint Intelligence Committee

INTRODUCTION

The likelihood of war with the Soviet Union and the ways by which it might come about are examined in our reports JIC(65) 87 (Final) and JIC(66) 77 (Revised Final) in which we concluded that "the Soviet leaders will not deliberately start a general war and are most unlikely deliberately to start a limited war". We also concluded that war between the Soviet Union and the West could result from miscalculation, but that this was unlikely. Notwithstanding these assessments there is a requirement to provide views on how the Soviet armed forces might be employed in the event of general war.

2. In examining this problem we assume that a critical situation in some part of the world has given rise to a period of mounting tension between the Soviet Union and the West; and that as a result of a process of miscalculation the Soviet Union decides on all-out war, including a full-scale strategic nuclear attack. Probable plans for the employment of Soviet armed forces in this latter circumstance are discussed below.

3. We believe that the overriding Soviet aim in general war would be to limit damage to the Soviet Union to the greatest extent possible. With this in mind, their military objectives are likely to be -

(a) Primary Objective
To destroy as much as possible of the Western strategic offensive capability and the Western will to fight;

(b) Secondary Objective
To engage and defeat such other Western military forces as remained, in order subsequently to extract any possible advantage for the Soviet Union.

8. It would seem logical therefore for the Russians to conclude that, having covered those nuclear strike force and air defence targets which are susceptible to attack, the most profitable targets in the United States would be those related to the aim of destroying the will and ability of the government and people to continue the war. These would include centres of governmental and military control and concentrations of industry and population.

9. In Europe, all worthwhile targets in NATO countries, including the United Kingdom, can be covered by the large MRBM/IRBM and medium bomber forces located in Western Russia.

WEAPONS SYSTEMS

ICBMs

10. ICBMs would be used against targets in North America; they have the advantage of giving a shorter warning time than aircraft and are suitable for the engagement of static targets. In addition to the systems now being deployed, there are several development projects under way which could result in operational systems during the period. A Fractional Orbit Bombardment System (FOBS) has been undergoing regular research and development testing and may be deployed as an operational system. If so it would add to the diversity of Russia's strategic threat, reduce warning times and make target prediction more difficult. A solid propellant ICBM is also believed to be under development, and mobile ICBM concepts are being investigated by the Russians. If deployed the mobile systems would supplement systems in permanent sites; solid propellant ICBMs might be deployed in new sites or installed as replacement missiles at existing sites.

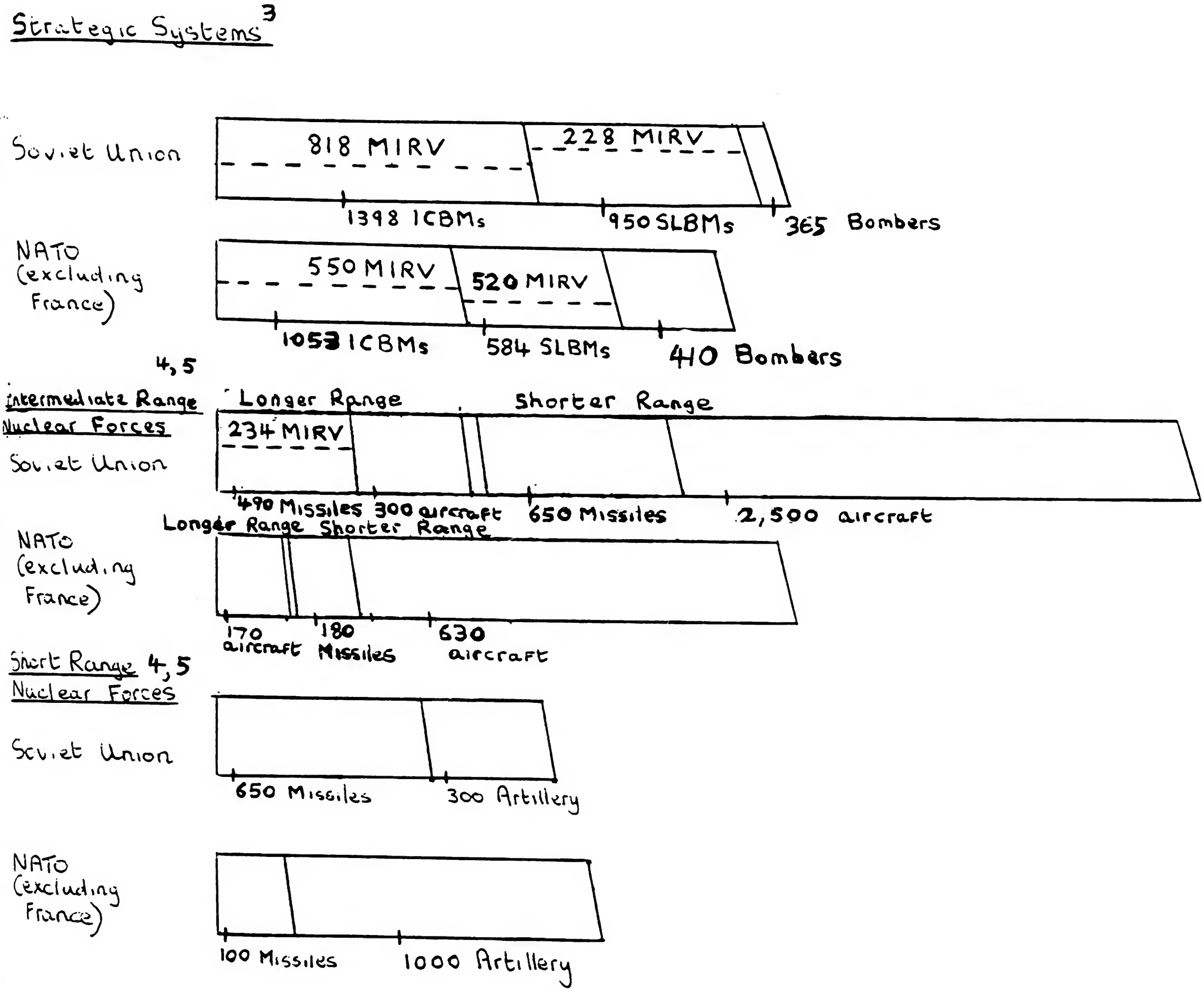
MRBM/IRBMs

11. MRBM/IRBMs have sufficient accuracy and warhead yield, together with short warning time, to be suitable for use against Western nuclear strike forces in Europe all of which are at present unhardened. They are also suitable for use against major cities, industrial targets and centres of control.

12. MRBMs would normally be launched from permanent sites. However, the Russians have constructed a large number of "field" type launch positions in the vicinity of permanent soft MRBM sites. These "field" sites are believed to have no permanent facilities but to consist of

CONFIDENTIAL

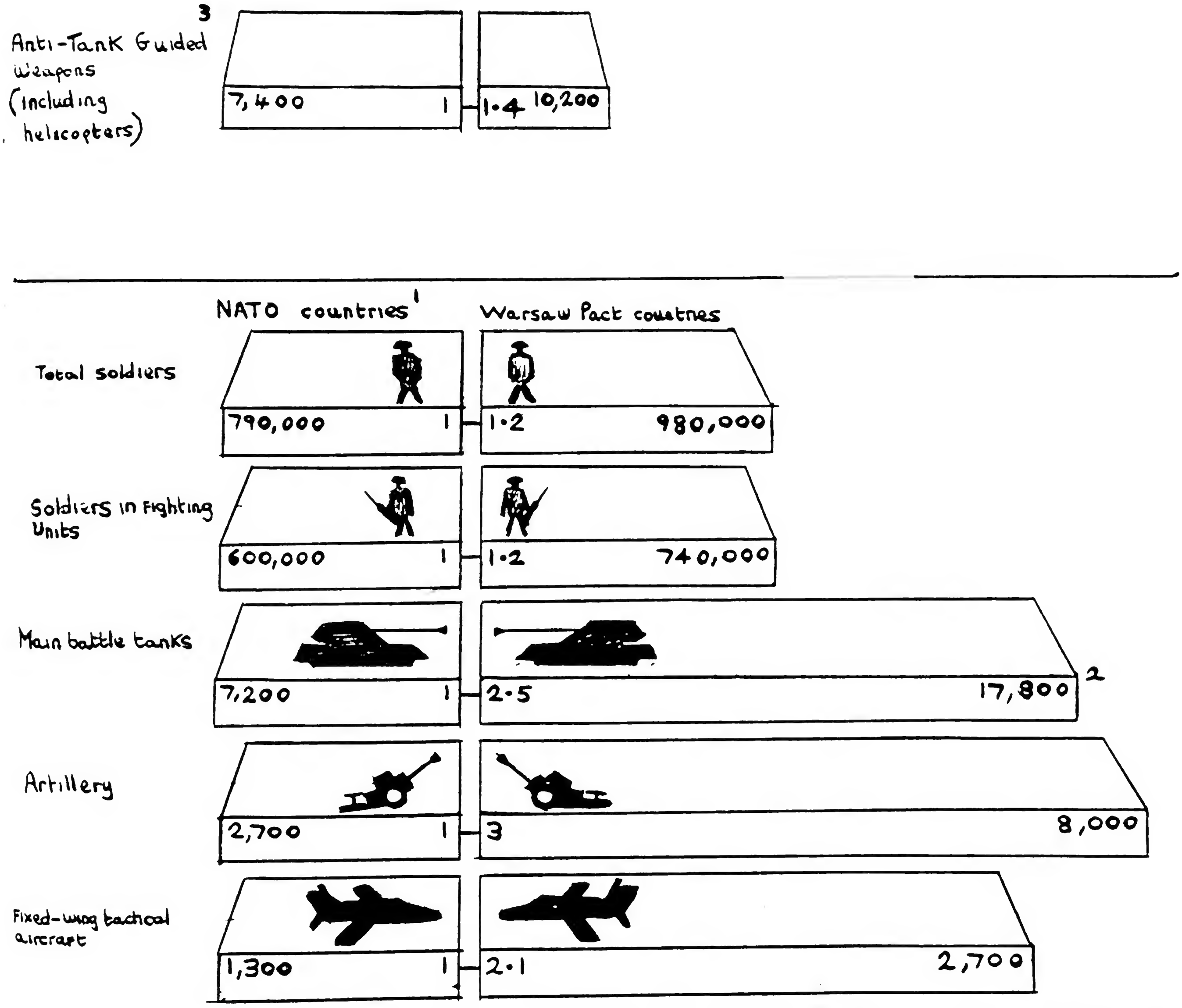
Figure 3 The Balance of Nuclear Forces End-1982[1,2]



CONFIDENTIAL

Figure 4

The Current Balance of Forces on the Central Front



1 Including French forces in the Federal Republic of Germany but excluding the Berlin garrison, which is not declared to NATO

2 Includes some Warsaw Pact tanks in training units and storage which would be available for operational use

3 Weapons which are, or have the capability of being, vehicle or helicopter mounted.

CIVIL DEFENCE
INSTRUCTORS' NOTES

Welfare Section

Part III

Evacuation and Care of the Homeless

PUBLISHED FOR THE HOME OFFICE
AND MINISTRY OF HOUSING AND LOCAL GOVERNMENT
BY HER MAJESTY'S STATIONERY OFFICE

HOME OFFICE

MINISTRY OF HOUSING AND LOCAL GOVERNMENT

(published in August 1960)

Civil Defence Instructors' Notes

WELFARE SECTION

PART III

DISPERSAL

~~Evacuation~~ and Care of the Homeless

(NOTE: contrary to propaganda from CND, New Statesman's Duncan Campbell, and the USSR's "World Peace Council", civil defence evacuation in Britain helped to deter a Nazi "knockout blow" air raid: BEFORE we declared war on 3 September 1939 we evacuated children from London in "Operation Pied Piper". This is hard fact.)

LONDON

HER MAJESTY'S STATIONERY OFFICE

1960

PRICE 2s. 6d. NET

BILLETING SURVEY FORM

District.. Ward or Parish...

1 Address ....

....

2 Name of Householder...

3 Number of habitable rooms.......................

		Adult	Children (age)	
4 Number of persons ordinarily resident	Male	....	....	....
	Female	....	....	....

5 Is the house suitable for (*a*) Unaccompanied children...

(*b*) Aged-infirm ....

(*c*) Handicapped ....

(*d*) Expectant mothers ....

6 Is the householder willing to take unaccompanied children?..

7 Has the householder any spare beds, bedding, or other equipment?..

8 Any other comments (e.g. old age or infirmity of householder, etc.) ....

....

....

....

....

....

Date of visit... Signature of visitor..

REGISTRATION OF PRIORITY CLASS EVACUEES

PLACE OF REGISTRATION..

SHEET No....................

COUNCIL..

Train Parties

	Family Groups (including Adolescents)				Unaccompanied Children		
	Surname	Adults	Children	Total	Surname	Total Over 5	Total Under 5
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

REGISTRATION OF PRIORITY CLASS EVACUEES

PLACE OF REGISTRATION..

SHEET No....................

COUNCIL..

Special Transport

Surname Mr. Mrs. Miss	Address	Reason for Special Transport

HOMELESS PERSONS

PRELIMINARY REGISTRATION

(To be made as early as possible)

Date...

PLACE OF REGISTRATION.. SHEET NO...............................

	SURNAME OF FAMILY	ADULTS		CHILDREN UNDER 15	HOME ADDRESS	OTHER INFORMATION
		MALE	FEMALE			
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						

REST CENTRE REGISTER

Date ....

NAME OF REST CENTRE.. COUNCIL.. SHEET NO.................................

	SURNAME	CHRISTIAN NAME(S)	SEX	HOME ADDRESS	ADDRESS WHENCE ADMITTED (IF DIFFERENT)	DATE OF DEPARTURE	DESTINATION (X IF OFFICIALLY BILLETED)	OTHER INFORMATION
1	2	3	4	5	6	7	8	9
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								

CLOTHING EMERGENCY ISSUE FORM

Place of Issue..............................

Date..............................

Name ....

Address..............................

....

....

Number served in family..............................

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
MEN'S	*Over-coats*	*Trousers*	*Jerseys*	*Jackets*	*Shirts*	*Vests*	*Pants*	*Socks*	*Night-wear*	*Dressing Gowns*	*Boots Shoes*	*Welling-tons*	*Mackin-toshes*	*Braces Belts*	*Suits Battledress*	*Unclassified*
WOMEN'S	*Over-coats*	*Skirts*	*Jerseys Jackets*	*Dresses*	*Blouses*	*Vests*	*Knickers*	*Stock-ings*	*Night-wear*	*Dressing Gowns*	*Shoes*	*Welling-tons*	*Mackin-toshes*	*Belts Corsets*	*Costumes Battledress*	*Unclassified*
BOYS'	*Over-coats*	*Shorts*	*Jerseys*	*Jackets*	*Shirts*	*Vests*	*Pants*	*Socks*	*Night-wear*	*Dressing Gowns*	*Boots Shoes*	*Welling-tons*	*Mackin-toshes*	*Braces Belts*	*Suits Battledress*	*Unclassified*
GIRLS'	*Over-coats*	*Skirts*	*Jerseys*	*Dresses*	*Blouses*	*Vests*	*Knickers*	*Stock-ings*	*Night-wear*	*Dressing Gowns*	*Shoes*	*Welling-tons*	*Mackin-toshes*	*Belts*	*Costumes Battledress*	*Unclassified*
UNDER 4's	*Coats*	*Shorts Skirts*	*Jerseys*	*Suits Dresses*	*Shirts Blouses*	*Vests*	*Pants Pilches*	*Socks*	*Night-wear*	*Dressing Gowns*	*Shoes*	*Welling-tons*	*Mackin-toshes*	*Bodices*	*Nappies*	*Layettes*

Signature of Recipient..............................

Signature of Member Issuing..............................

CLOTHING REQUEST FORM

No.:..................................

To..Supply Depot

From (Place)..

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
MEN'S	*Over-coats*	*Trousers*	*Jerseys*	*Jackets*	*Shirts*	*Vests*	*Pants*	*Socks*	*Night Wear*	*Dressing Gowns*	*Boots Shoes*	*Welling-tons*	*Mackin-toshes*	*Braces Belts*	*Suits Battle-dress*	*Unclassified*	*Remarks*
Requested																	
Sent																	
WOMEN'S	*Over-coats*	*Skirts*	*Jerseys Jackets*	*Dresses*	*Blouses*	*Vests*	*Knickers*	*Stock-ings*	*Night Wear*	*Dressing Gowns*	*Shoes*	*Welling-tons*	*Mackin-toshes*	*Belts Corsets*	*Costumes Battle-dress*	*Unclassified*	*Remarks*
Requested																	
Sent																	
BOYS'	*Over-coats*	*Shorts*	*Jerseys*	*Jackets*	*Shirts*	*Vests*	*Pants*	*Socks*	*Night Wear*	*Dressing Gowns*	*Boots Shoes*	*Welling-tons*	*Mackin-toshes*	*Braces Belts*	*Suits Battle-dress*	*Unclassified*	*Remarks*
Requested																	
Sent																	
GIRLS'	*Over-coats*	*Skirts*	*Jerseys Jackets*	*Dresses*	*Blouses*	*Vests*	*Knickers*	*Stock-ings*	*Night Wear*	*Dressing Gowns*	*Shoes*	*Welling-tons*	*Mackin-toshes*	*Belts*	*Costumes Battle-dress*	*Unclassified*	*Remarks*
Requested																	
Sent																	
UNDER 4's.	*Coats*	*Shorts Skirts*	*Jerseys*	*Suits Dresses*	*Shirts Blouses*	*Vests*	*Pants Pilches*	*Socks*	*Night Wear*	*Dressing Gowns*	*Shoes*	*Welling-tons*	*Mackin-toshes*	*Bodices*	*Nappies*	*Layettes*	*Remarks*
Requested																	
Sent																	

Signature of member requesting.. Date....................................

Signature of member sending clothing.. Date....................................

Two copies to be sent to SUPPLY DEPOT which keeps one copy, and RETURNS the other with the clothing.

CLOTHING STOCK RETURN

PAGE..............................

	Date	A *Over-coats*	B *Trousers Skirts*	C *Jerseys *Jackets*	D *Jackets Dresses*	E *Shirts Blouses*	F *Vests*	G *Pants Knickers*	H *Socks Stock-ings*	I *Night wear*	J *Dressing Gowns*	K *Boots Shoes*	L *Welling-tons*	M *Mackin-toshes*	N *Braces Belts Corsets*	O *Suits Costumes Battle-dress*	P *Unclassified*
MEN'S Stock																	
Further stock received																	
Total																	
Total on stocktaking																	
Garments requested																	
WOMEN'S Stock																	
Further stock received																	
Total																	
Total on stocktaking																	
Garments requested																	
BOYS' Stock																	
Further stock received																	
Total																	
Total on stocktaking																	
Garments requested																	
GIRLS' Stock																	
Further stock received																	
Total																	
Total on stocktaking																	
Garments requested																	
UNDER 4's.		*Coats*	*Shorts Skirts*	*Jerseys*	*Suits Dresses*	*Shirts Blouses*	*Vests*	*Pants Pilches*	*Socks*	*Night wear*	*Dressing gowns*	*Shoes*	*Welling-tons*	*Mackin-toshes*	*Bodices*	*Nappies*	*Layettes*
Stock																	
Further stock received																	
Total																	
Total on stocktaking																	
Garments requested																	

* For women and girls.

(After stocktaking, start a new page, and carry forward " Total on stocktaking ")

THE PURPOSE OF ~~EVACUATION AND~~ CARE OF THE HOMELESS

A. Aims

1 *Care of the Homeless:* The provision of shelter and practical help for those who lose their homes or have to leave them because of enemy action.

~~2 *Evacuation:* To disperse part of the population before an attack, with the object of saving life.~~

B. Plans

3 *Care of the Homeless:* Plans for the temporary accommodation of the homeless are based on the use of existing buildings as rest centres in which the homeless can be lodged temporarily until they can be found more permanent accommodation in billets or requisitioned houses. The responsibility for providing rest centres lies with county and county borough councils who are responsible for the ordinary peace time welfare services. The responsibility for billeting and otherwise housing the homeless rests with county borough and county district councils who are the housing authorities in peace time. The decision to open rest centres in war would rest with the appropriate civil defence controller. County councils may delegate the day to day administration of the rest centre service to county district councils, in which case there will be a need for close liaison between the district council officer in charge locally and the chief rest centre officer of the county. The Ministry of Housing and Local Government is the Department responsible for rest centre service policy.

4 *Evacuation:* Evacuation policy is the responsibility of the Ministry of Housing and Local Government. It would be the responsibility of the Government as a whole to decide whether to put any previously prepared evacuation scheme into operation on the threat of war. They would have to consider whether there was time to complete the operation before war broke out.

Evacuation, like other defence planning, has to take account of the latest assessments of the type of attack that might be launched and the means of defence against it. At the present time the Government are reconsidering the proposals for the evacuation of 12 million members of the priority classes, which were announced in 1956. It may be assumed however that any future evacuation plans will have the following basic features:

(*a*) The country will be divided into evacuation, neutral and reception areas.

(*b*) Evacuation areas will be linked as far as possible with specific reception areas.

(*c*) The main movement will be by rail.

(*d*) There will be priority classes (e.g., women, children, the aged and infirm, blind, crippled, etc.).

(*e*) The scheme will be voluntary.

(*f*) The details of running it will be the responsibility of the following local authorities:

(i) In *evacuation* areas the county boroughs and county district councils will be responsible for assembling those to be evacuated and seeing that they are entrained (special arrangements will be made for the London area, under which the L.C.C. will be responsible).

(ii) In *reception* areas county councils will be responsible for the reception of evacuees at detraining points and for their onward transport to their reception areas. County district councils (and county boroughs) will be responsible for the local reception of evacuees, their billeting and their general welfare thereafter.

REST ~~AND RECEPTION~~ CENTRES

Rest Centres

2 (*a*) *Definition*

A building used for the temporary accommodation of homeless persons until such time as they can return to their homes or be billeted or otherwise rehoused.

(*b*) *Types of Rest Centres*

(i) *Planned Centres:* Those earmarked in advance. Some may be large buildings with good facilities (e.g. schools) and a certain amount of equipment immediately available. There may be an emergency meals centre in the same building.

WE 8: 1

MOVEMENT

Unplanned movement of homeless from a damaged area

4 (*a*) Despite exhortations to " stay put " under cover after a nuclear attack, there will inevitably be a number, perhaps a very large number, of people who will seek to escape from the damaged areas; others will be driven from their homes by fire or by the destruction of effective cover. The control of this movement of the homeless will be largely a matter for the police and wardens, aided by street leaders, whose aim will be (1) to get the homeless under cover in any available accommodation and (2) to keep them away from the essential services routes.

(*b*) It is likely that in damaged areas no trained help may be available from the Welfare Section, e.g., in temporary refuges where homeless have been directed in order to get them under cover quickly. In such cases reliance must be on self-help; the only amenities will be those which are to be found in the refuge or which are brought in by the occupants. Where it is possible for Welfare Section members to get to refuges where a number of homeless are known to have congregated they should do so and give what help they can under the existing circumstances. The most important problems are likely to be those connected with first aid, sanitation and water.

Movement from fall-out areas

5 (*a*) After nuclear attack, it may be necessary to evacuate everyone from areas in which radioactivity from fall-out exceeds a certain intensity. Such a movement will not be possible until about 48 hours after the attack, and it will then be carried out on instructions from the control organisation.

(*b*) Welfare Section members will be concerned with the arrangements for the reception of persons evacuated from such areas. The procedure to be followed will be similar to that for other homeless persons. Initially they will be accommodated in rest centres; later, as far as circumstances permit, they will be billeted. It must be remembered that the incidence of radiation sickness among persons evacuated from areas of intense radioactivity is likely to be high.

Notes on teaching WE 8

6 Reference may be made to the Manual of Civil Defence, Volume I, Pamphlet No. 2 " Radioactive Fall-out Provisional Scheme of Public Control " and to WE/WF 34 " Control of the Public in Radioactive Zones ". (See also Note WE/WF 3, Part II.)

7 Throughout this session emphasis should be on the need for speed because:

~~(*a*) Any delay in the evacuation movement might mean that thousands of people would remain at risk who might otherwise have been moved.~~

(*b*) In view of the danger of radioactive fall-out it is essential that homeless should be got under cover without delay; shelter in a damaged building is better than remaining in the open.

ARRANGEMENTS FOR MEDICAL CARE

Introduction

1 In time of war the number of doctors and trained nurses available would inevitably fall far short of the need. It follows therefore that many injuries and illnesses, where normally skilled medical aid would be sought, will have to be dealt with by untrained or semi-trained helpers. A great deal of this work will fall to the lot of members of the Welfare Section and it is essential that all volunteers should acquire as much experience as possible in Home Nursing and First Aid. As far as possible families should be kept together and should tend each other.

Rest Centres

2 Rest centres will be working under conditions of great stress but must have space set aside for homeless persons requiring nursing care or first aid. The proportion of the accommodation of a rest centre which will be needed at any one time for this purpose will vary initially according to the location of the centre, and later, to the demands placed upon it.

In rest centres near the area of damage, it is likely that a large number of the homeless will need early treatment in some form or other. In addition if a Forward Medical Aid Unit is working in the vicinity some of the less seriously injured and psychiatric casualties who have passed through and have been discharged by the Unit will be homeless and may need further care at the rest centre.

The length of time the casualties will have to remain in the rest centres will depend on circumstances but in some instances it may have to be for a considerable time. Help in caring for casualties should be obtained from members of the patient's family or able-bodied homeless with particular skill and experience. When circumstances permit, advice and some assistance may be available to the rest centre staff from general practitioners and local authority nurses in the area.

Clearance from Z Zones *

3 Persons cleared from Z Zones will normally be brought to rest centres and the procedure for meeting their immediate needs and for billeting will be as for any other homeless. It must be remembered, however, that among those brought out from the Z Zone some will have received a large dose of radiation and may be expected to develop radiation sickness. Cases of radiation sickness will not normally be admitted to hospital since treatment consists mainly of rest and quiet and hospital beds will be needed for more urgent cases. There are several phases in the illness, and the nature, and scope of the provision which will have to be made will depend to some extent on the time which has elapsed since the radiation dose was received. The vomiting and diarrhoea are distressing and unpleasant, and it may be desirable to set aside special centres for treating cases of the sickness. Nursing could be on a rota system, shared by members of the Welfare Section and others willing and able to help.

* Z Zones are defined as areas above 10 R/hr (10 cGy/hr) of gamma at 48 hrs after burst.

WELFARE IN BILLETS

Main headings

1 Immediate and long term welfare; visiting and supervision of billets; problems of shared homes; unaccompanied children; special groups.

Immediate welfare

2 Initial billeting would have to be carried out at speed and under great pressure. Immediate welfare would consist simply of seeing that evacuees had a roof over their heads and enough food for their needs.

Long term welfare

3 This is an entirely different problem. If a heavy attack on this country followed closely on evacuation, the life-saving aspect of the scheme would be appreciated; people would be ready to accept the extreme discomfort involved and would realise that only help with major difficulties would be possible. If, however, there were no immediate attack, or if a large part of the country were unaffected, many individual difficulties would be brought forward which in an extreme crisis might have been accepted. The Welfare Section will have a large part to play in helping to solve these individual problems which cannot be ignored since to do so would lead to a wide-spread lowering of morale. It must be remembered also that the need for billeting will continue for a long time after the acute phase of hostilities. Training should prepare the volunteer for the more detailed aspect of long-term welfare; some of the service for which training is given may not be needed or may not be practicable, but it is better to train to the ideal and to get as near to it in practice as circumstances permit.

Visiting and supervision of billets

4 (*a*) The amount of visiting will depend on conditions existing at the time and the number of suitable staff available. The initial introduction of evacuee to householder should if possible be made by a responsible person. Doorstep altercations may be avoided if both sides feel that the situation is being handled by some one in authority.

(*b*) Billeting visitors would form a link between the household and the billeting office. Very large numbers of billeting assistants and visitors will be needed if they are to keep in touch with households. There will be a need for tact and complete impartiality, as well as a detailed knowledge of the help available.

(*c*) Billets should be visited within a few days of the initial billeting in order to advise on major difficulties which may have arisen. Further visits would depend on circumstances. If the household is settling down reasonably well, it would be better not to visit too often, but both householder and evacuee must know where to go if help is needed.

(*d*) In billets where there are unaccompanied children regular visits should be made. Frequent visits should be made in the early stages; later, if all seems well, once a month might be sufficient. Children who were in the care of the local authority (i.e., under the Children Act, 1948 or the Children and Young Persons' Act, 1933) at the time of evacuation, would come under the supervision of the Children's Officer in the reception area; other unaccompanied children would be supervised by the staff of the billeting officer.

Problems of shared homes

5 (*a*) Sharing a home is never easy even when the families are known to each other and sharing is by mutual agreement. Sharing under conditions resulting from evacuation will be infinitely more difficult.

(*b*) As far as possible householder and evacuee should work out their own plan for sharing, but the billeting visitor should be ready to discuss plans and to advise if asked to do so. Both evacuee and householder should appreciate the other's point of view; preparatory work in this connection might be possible.

(*c*) Common difficulties arising from shared homes:

(i) responsibility for shared kitchens and bathrooms; timing of meals, etc.;
(ii) apportionment of cost of light and fuel;
(iii) responsibility for cleaning passages, stairs, etc.;
(iv) use of cleaning materials and cooking utensils.

(*d*) The social standards and customs of evacuees and householder may be entirely different. The easiest solution would be for families to live completely independently but the size of the house and the available rooms might make this impracticable.

Needs of special groups

Unaccompanied children

6 (*a*) Special arrangements will be made for certain groups of unaccompanied children, i.e. (1) nursery and nursery school children (2) children attending special schools (e.g., for the handicapped). These groups will be accompanied by their own staff and will go to pre-arranged accommodation in the reception areas; it is unlikely that Welfare Section members will be called upon to help.

(*b*) Those children whose relatives cannot accompany them will be collected together in parties, sent to reception areas and billeted in private houses. The choice of billets for unaccompanied children should receive special care;

(i) they should only be billeted on persons willing to accept them;
(ii) if possible they should be billeted on persons accustomed to the care of children;
(iii) the billet must be visited regularly to ensure that the children are being well cared for. The billeting visitor should establish friendly relations with the householder so that visits are not looked upon as an intrusion but as an opportunity for friendly discussion.

(*N.B. See earlier reference to children in care of the local authority.*)

(*c*) Even householders accustomed to children may not be prepared for problems which may arise when a child is separated from his family. Such problems are likely to be more acute when separation is the result of hurried evacuation without an opportunity for mental preparation. The child's insecurity may show itself in:

(i) bed-wetting;
(ii) problems of behaviour—extreme aggressiveness or timidity, temper tantrums, pilfering.

Kindness and commonsense handling will usually enable the difficulties to be overcome, but the billeting visitor must be able to advise the householder and must know what practical help is available. Cases of real difficulty should be reported to the billeting officer.

7 In addition to unaccompanied children there will be other groups whose welfare will need special consideration:

(a) Expectant mothers

Special arrangements will be made for those within one month of their expected date of confinement; others will be billeted in the ordinary way but may move to special lying-in accommodation later, if such accommodation should be available.

The address of expectant mothers' billets should be notified to the Medical Officer of Health so that Health Visitors may visit and advise. On leaving hospital, mother and baby will be re-billeted. It would be an obvious advantage if they could return to her former billet. Special arrangements may have to be made for the care of other children in the family while their mother is in hospital.

(b) Aged-infirm, blind persons and cripples

If the degree of infirmity or handicap is not too great, these will be billeted in private households. Many aged and handicapped will be accompanied by members of their family who will be responsible for their general welfare. Those who are unaccompanied may need specially selected billets:

(i) With householders who are prepared to give the extra care necessary.

(ii) In houses suitable for the particular disability, e.g., few stairs, indoor sanitation, etc.

The local authority's welfare officer and/or any appropriate voluntary organisation in the neighbourhood should be put in touch.

(c) Adolescents

A new priority class in the revised evacuation scheme. In general, adolescents will be part of family units and may be billeted with that family. They may need suitable work and this will be dealt with by the local office of the Ministry of Labour and National Service. Where possible, organised activity for out-of-work hours should be arranged. Social clubs and organisations should be asked to extend their facilities to evacuated young people. Billeting visitors should know what is available.

Notes on teaching WE 10

8 Volunteers who are likely to be called upon to act as billeting visitors should take advantage of any opportunity of any activity which brings them in contact with all types of people, e.g., helping with clubs, outings, welfare clinics, etc. and so gain experience in social work.

9 The instructor should make it clear that the priority classes mentioned in his talk are those of the provisional evacuation scheme.

10 Volunteers should make themselves familiar with the peace-time welfare services in their neighbourhood, both statutory and voluntary, but must realise that many, if not all, of these services might be disrupted by war.

11 In dealing with human problems the personality of the individual concerned plays a very large part in deciding how a situation may best be handled. Any approach must be extremely flexible and capable of being adapted to meet the circumstances.

Environmental Radiation Protection Factors
Provided by Civilian Vehicles

Vehicle	Position	Protection Factor Range
Commercial bus (common type)	Throughout bus	1.5-2.0
Commercial bus (scenic cruiser type)	Throughout bus	1.5-2.0
School bus	Throughout bus	1.5-1.8
Passenger car	Passenger side (chest)	1.5-1.7
	Driver side	1.5-1.7
Pickup	Driver side	1.9-2.1
Crew cab	Driver side	1.8-2.0
	Back seat	1.8-2.0
Carryall	Driver side	1.7-1.9
	Rear side	1.7-1.9
2-1/2-ton truck	Driver side	1.8-2.0
	Center of bed	1.4-1.6
5-ton truck	Driver side	2.0-2.2
	Sleeper	1.9-2.1
Heavy Truck	Driver side	1.4-1.6
	Center of trailer	2.7-3.1
Fire truck	Driver side	2.7-3.1
	Standing area in back	1.6-1.8
Switch engine	Engineer's seat	3.0-3.5
Railway guard car	Sleeping quarters	2.2-2.6
	Kitchen area	2.4-2.8
	Center area	2.0-2.4
Heavy locomotive	Engineer's seat	3.0-3.5

SOURCE: Z. G. Burson, "Environmental and Fallout Gamma Radiation Protection Factors Provided by Civilian Vehicles," Health Physics, 26, 41-44, 1974.

SHELTER
"CORES"

Outdoor Fall-out Shelter

If it is impossible for you to prepare an indoor fall-out shelter, a trench dug outside your home would provide good protection. It should be deep enough to provide comfortable standing room and the sides should be shored up. After placing supports across the trench, cover the top with boards, metal sheets or concrete slabs, and heap earth on top. Leave a manhole-type entrance with a movable cover such as a dustbin lid. Keep a small ladder or a pair of household steps there.

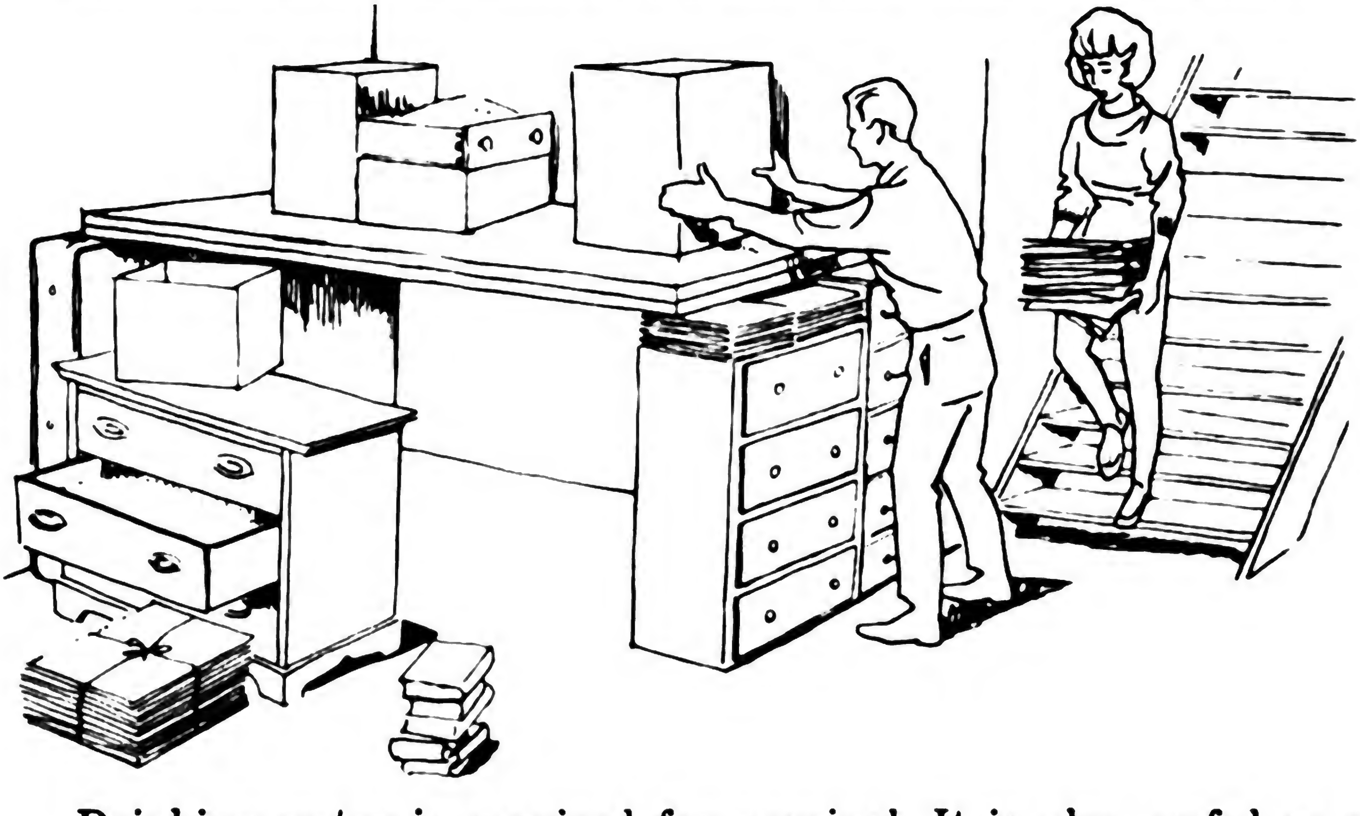
PERSONAL AND FAMILY SURVIVAL

SM-3-11

"...the history of this planet and particularly the history of the 20th Century is sufficient to remind us of the possibilities of an irrational attack, a miscalculation, and accidental war, or a war of escalation in which the stakes by each side gradually increase to the point of maximum danger which cannot be either foreseen or deterred. It is on this basis that civil defense can be readily justified—as insurance for the civilian population in case of enemy miscalculation. It is insurance we trust will never be needed—but insurance which we would never forgive ourselves for foregoing in the event of catastrophe."

— President Kennedy, in May 1961

Remove doors from their hinges and place them over supports



Drinking-water is required for survival. It is also useful as a shielding material. A collapsible children's swimming pool filled with water and located over the best corner of your basement will help improve the fallout protection. A bathtub, if suitably located, can also be used for this purpose.

DEPARTMENT OF DEFENSE
OFFICE OF CIVIL DEFENSE

Foreword

If the country were ever faced with an immediate threat of nuclear war, a copy of this booklet would be distributed to every household as part of a public information campaign which would include announcements on television and radio and in the press. The booklet has been designed for free and general distribution in that event. It is being placed on sale now for those who wish to know what they would be advised to do at such a time.

May 1980

Protect and Survive
ISBN 0 11 3407289

If Britain is attacked by nuclear bombs or by missiles, we do not know what targets will be chosen or how severe the assault will be.

If nuclear weapons are used on a large scale, those of us living in the country areas might be exposed to as great a risk as those in the towns. The radioactive dust, falling where the wind blows it, will bring the most widespread dangers of all. No part of the United Kingdom can be considered safe from both the direct effects of the weapons and the resultant fall-out.

The dangers which you and your family will face in this situation can be reduced if you do as this booklet describes.

Planning for survival

Stay at Home

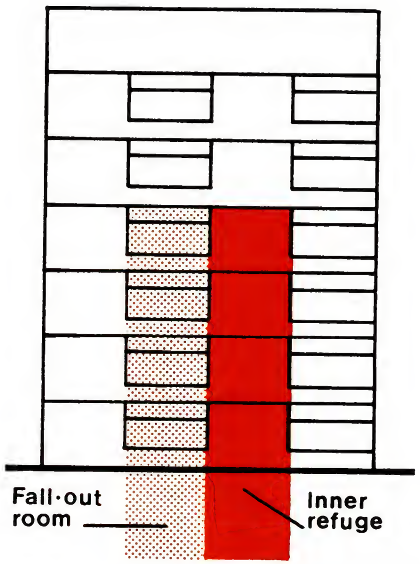
Your own local authority will best be able to help you in war.
If you move away – unless you have a place of your own to go to or intend to live with relatives – the authority in your new area will not help you with accommodation or food or other essentials.
If you leave, your local authority may need to take your empty house for others to use.
So stay at home.

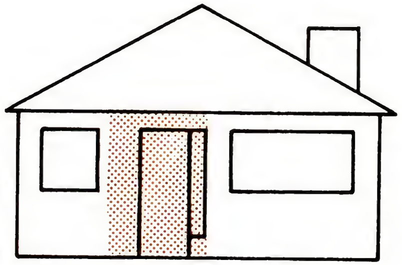
Plan a Fall-out Room and Inner Refuge

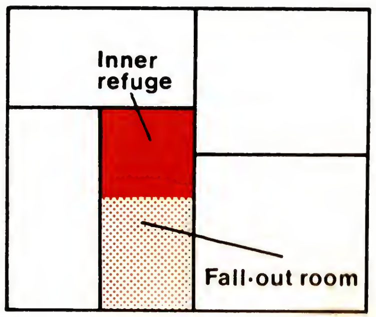
The first priority is to provide shelter within your home against radioactive fall-out. Your best protection is to make a fall-out room and build an inner refuge within it.

First, the Fall-out room

Because of the threat of radiation you and your family may need to live in this room for fourteen days after an attack, almost without leaving it at all. So you must make it as safe as you can, and equip it for your survival. Choose the place furthest from the outside walls and from the roof, or which has the smallest amount of outside wall. The further you can get, within your home, from the radioactive dust that is on or around it, the safer you will be. Use the cellar or basement if there is one. Otherwise use a room, hall or passage on the ground floor.







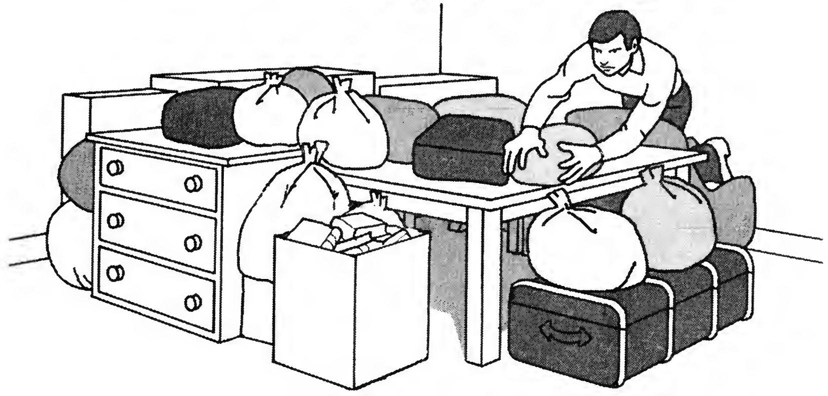
Protect and Survive
UK Government, May 1980

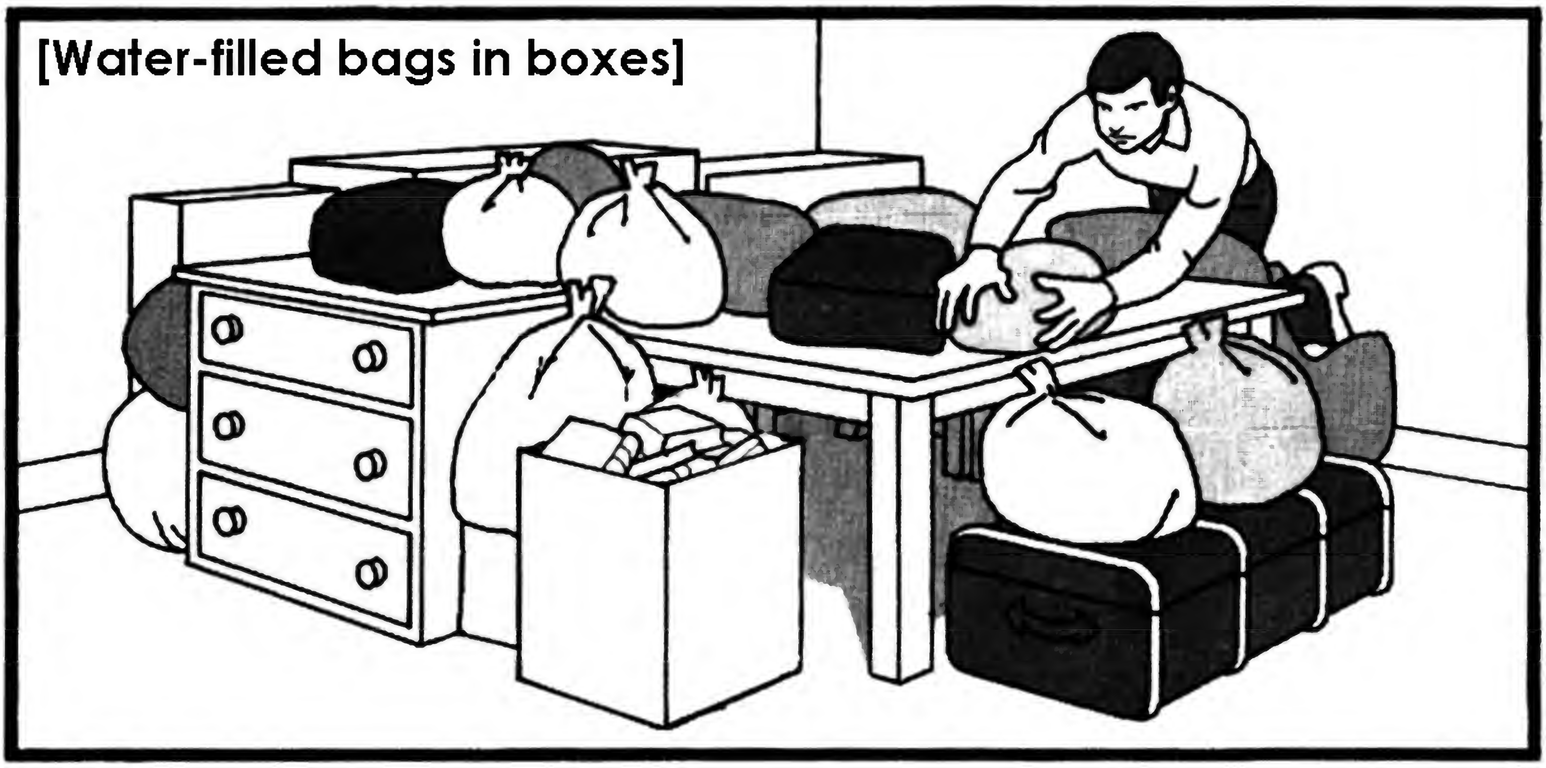
Now the Inner Refuge

Still greater protection is necessary in the fall-out room, particularly for the first two days and nights after an attack, when the radiation dangers could be critical. To provide this you should build an inner refuge. This too should be thick-lined with dense materials to resist the radiation, and should be built away from the outside walls.

Here are some ideas:

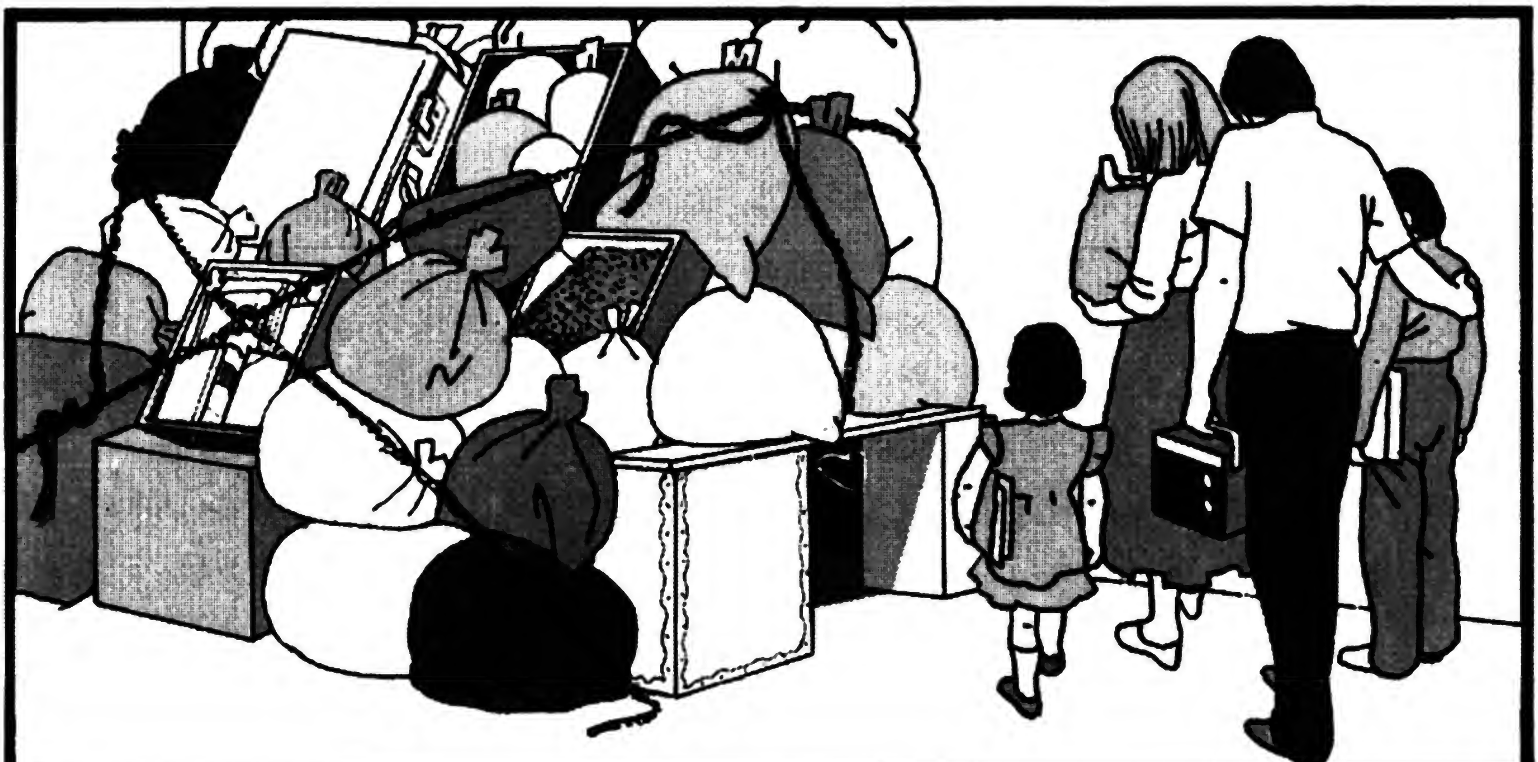
Make a 'lean-to' with sloping doors taken from rooms above or strong boards rested against an inner wall. Prevent them from slipping by fixing a length of wood along the floor. Build further protection of bags or boxes of earth or sand – or books, or even clothing – on the slope of your refuge, and anchor these also against slipping. Partly close the two open ends with boxes of earth or sand, or heavy furniture.





If there is structural damage from the attack you may have some time before a fall-out warning to do minor jobs to keep out the weather – using curtains or sheets to cover broken windows or holes.

If you are out of doors, take the nearest and best available cover as quickly as possible, wiping all the dust you can from your skin and clothing at the entrance to the building in which you shelter.



Proceedings of the Symposium
held at Washington, D. C.
April 19-23, 1965 by the
Subcommittee on Protective Structures,
Advisory Committee on Civil Defense,
National Academy of Sciences—
National Research Council

Protective Structures

for

CIVILIAN POPULATIONS

1966

THE PROTECTION AGAINST FALLOUT RADIATION AFFORDED BY CORE SHELTERS IN A TYPICAL BRITISH HOUSE

Daniel T. Jones
Scientific Adviser, Home Office, London

Protective Factors in a Sample of British Houses (Windows Blocked)

Protective Factor	Percentage of Houses
< 25	36%
25-39	28%
40-100	29%
> 100	7%

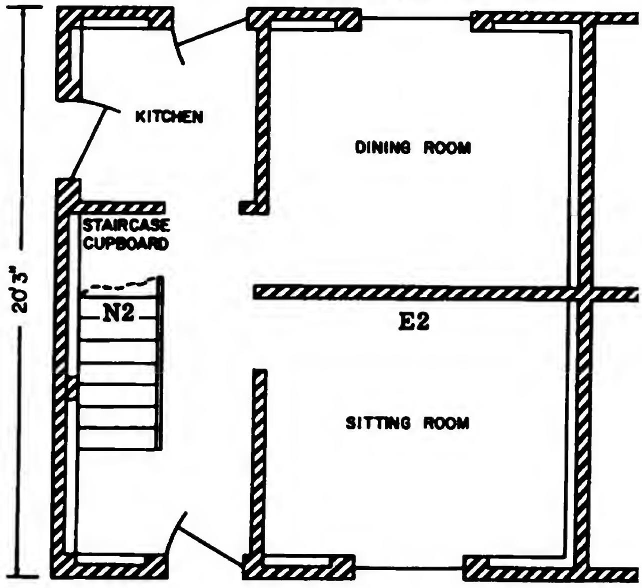
"A very much improved protection could be obtained by constructing a shelter core. This means a small, thick-walled shelter built preferably inside the fallout room itself, in which to spend the first critical hours when the radiation from fallout would be most dangerous."(1)

The full-scale experiments were carried out at the Civil Defense School at Falfield Park.(2)

In the staircase construction, the shelter consisted of the cupboard under the stairs, sandbags being placed on treads above and at the sides.

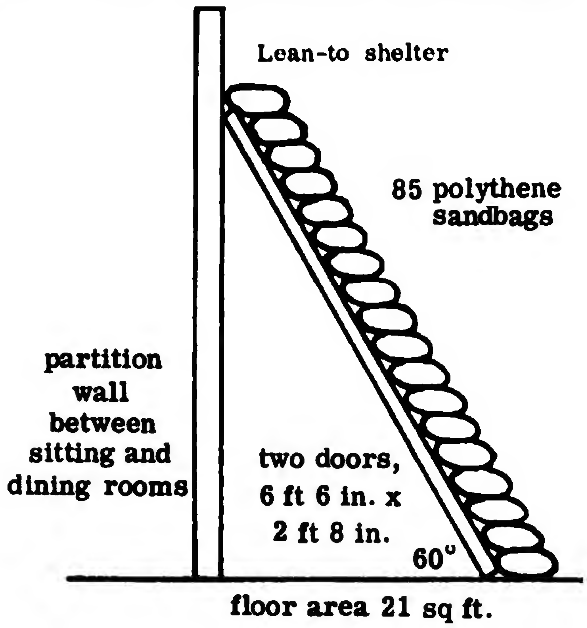
A 93 curies cobalt-60 source was used.

1. Six sandbags per tread, and a double layer on the small top landing. 96 sandbags were used.
2. As (1), together with a 4-ft-high wall of sandbags along the external north wall. 160 sandbags were used.
3. As (2), together with 4-ft-high walls of sandbags along the kitchen/cupboard partition wall and along the passage partition. 220 sandbags were used.



sandbags 24 in. x 12 in. when empty; 16 in. x 9 in. x 4 in. when filled with 25 lb of sand.

9 in. brick walls The windows and doors were not blocked	Position	contribution $r/hr/c/ft^2$ Ground	Roof	Protective Factor
House only	E2	15.0	8.4	21
Lean-to	E2	10.4	2.4	39
Staircase cupboard:				
Stairs only sandbagged	N2	29.2	5.3	14
Stairs and outer wall sandbagged	N2	16.4	4.6	24
Stairs, outer wall, kitchen wall and corridor partition sandbagged	N2	8.8	1.8	47



1. Civil Defence Handbook No. 10, HMSO, 1963.
2. Perryman, A. D., Home Office Report CD/SA 117.

MODEL ANALYSIS

Mr. Ivor Ll. DAVIES
Suffield Experimental Station
Canadian Defense Research Board
Ralston, Alberta, Canada

Nuclear-Weapon Tests

In 1952 we fired our first nuclear device, effectively a "nominal" weapon, at Monte Bello, off northwest Australia. To the blast loading from this weapon we exposed a number of reinforced-concrete cubicle structures that had been designed for the dynamic loading conditions, and for which we made the best analysis of response we were competent to make at that time. Our estimates of effects were really a dismal failure. The structures were placed at pressure levels of 30, 10, and 6 psi, where we expected them to be destroyed, heavily damaged with some petaling of the front face, and extensively cracked, respectively. In fact, the front face of the cubicle at 30 psi was broken inwards; failure had occurred along both diagonals, and the four triangular petals had been pushed in. At the 10-psi level, where we had three cubicles, each with a different wall thickness (6, 9, and 12 in.), we observed only light cracking in the front face of that cubicle with the least thick wall (6 in.). The other two structures were apparently undamaged, as was the single structure at the 6-psi level.

In 1957, the first proposals were made for the construction of the underground car park in Hyde Park in London. The Home Office was interested in this project since, in an emergency, the structure could be used as a shelter. Consequently a request was made to us at Atomic Weapons Research Establishment (A.W.R.E.) to design a structure that would be resistant to a blast loading of about 50 psi, and to test our design on the model scale.

Using the various load-deformation curves obtained in this test, an estimate was made of the response of the structure to blast loading. Of particular interest was the possible effect of 100 tons of TNT, the first 100-ton trial at Suffield in Alberta.

10 p.s.i.

34 p.s.i.

Dynamic tests, Monte Bello cubicles.

A total of seven more models was made; six were shipped to Canada and placed with the top surface of the roof flush with the ground and at positions where peak pressures of 100, 80, 70, 60, 50, and 40 psi were expected. The seventh model was kept in England for static testing at about the time of firing. The results were not as expected. In the field, the four models farthest from the charge were apparently undamaged; we could see no cracking with the eye, nor did soaking the models with water reveal more than a few hair cracks. The model nearest the charge was lightly cracked in the roof panels and beams, and one of the columns showed slight spalling at the head. This model had been exposed to a peak pressure of 110 psi.

BLAST AND OTHER THREATS

Harold Brode
The RAND Corporation, Santa Monica, California

Chemical High-Explosive Weapons

As in past aerial warfare, bombs and missiles carrying chemical explosives to targets are capable of extensive damage only when delivered in large numbers and with high accuracy.

Biological Warfare

Most biological agents are inexpensive to produce; their effective dissemination over hostile territories remains the chief deterrent to their effective employment. Twenty square miles is about the area that can be effectively covered by a single aircraft; large area coverage presents a task for vast fleets of fairly vulnerable planes flying tight patterns at modest or low altitudes. While agents vary in virulence and in their biologic decay rate, most are quite perishable in normal open-air environments. Since shelter and simple prophylactic measures can be quite effective against biological agents, there is less likelihood of the use of biological warfare on a wholesale basis against a nation, and more chance of limited employment on population concentrations —perhaps by covert delivery, since shelters with adequate filtering could insure rather complete protection to those inside.

Chemical Weapons

Chemical weapons, like biological weapons, are relatively inexpensive to create, but face nearly insurmountable logistics problems on delivery. Although chemical agents produce casualties more rapidly, the greater amounts of material to deliver seriously limit the likelihood of their large-scale deployment. Furthermore, chemical research does not hold promise of the development of significantly more toxic chemicals for future use.

Radiological Weapons

The advantages of such modifications are much less real than apparent. In all weapons delivered by missiles, minimizing the payload and total weight is very important. If the total payload is not to be increased, then the inclusion of inert material to be activated by neutrons must lead to reductions in the explosive yield. If all the weight is devoted to nuclear explosives, then more fission-fragment activity can be created, and it is the net difference in activity that must be balanced against the loss of explosive yield. As it turns out, a fission explosion is a most efficient generator of activity, and greater total doses are not achieved by injecting special inert materials to be activated.

Perret, W.R., Ground Motion Studies at High Incident Overpressure, The Sandia Corporation, Operation PLUMBBOB, WT-1405, for Defense Atomic Support Agency Field Command, June 1960.

The Neutron Bomb

The neutron bomb, so called because of the deliberate effort to maximize the effectiveness of the neutrons, would necessarily be limited to rather small yields—yields at which the neutron absorption in air does not reduce the doses to a point at which blast and thermal effects are dominant. The use of small yields against large-area targets again runs into the delivery problems faced by chemical agents and explosives, and larger yields in fewer packages pose a less stringent problem for delivery systems in most applications. In the unlikely event that an enemy desired to minimize blast and thermal damage and to create little local fallout but still kill the populace, it would be necessary to use large numbers of carefully placed neutron-producing weapons burst high enough to avoid blast damage on the ground, but low enough to get the neutrons down. In this case, however, adequate radiation shielding for the people would leave the city unscathed and demonstrate the attack to be futile.

The thermal radiation from a surface burst is expected to be less than half of that from an air burst, both because the radiating fireball surface is truncated and because the hot interior is partially quenched by the megatons of injected crater material.

SUPERSEISMIC GROUND-SHOCK MAXIMA (AT 5-FT DEPTH)

Vertical acceleration: $\alpha_{vm} \simeq 340\, \Delta P_s / C_L$ ± 30 per cent. Here acceleration is measured in g's and overpressure (ΔP_s) in pounds per square inch. An empirical refinement requires C_L to be defined as the seismic velocity (in feet per second) for rock, but as three fourths of the seismic velocity for soil.

OUTRUNNING GROUND-SHOCK MAXIMA (AT ~10-FT DEPTH)

Vertical acceleration: $\alpha_{vm} \simeq 2 \times 10^5 / C_L r^2$ + factor 4 or -factor 2. Acceleration is measured in g's, and r is the scaled radial distance—i.e., $r = R/W^{1/3}$ kft/(mt)$^{1/3}$.

Data taken on a low air-burst shot in Nevada indicate an exponential decay of maximum displacement with depth. For the particular case of a burst of ~ 40 kt at 700 ft, some measurements were made as deep as 200 ft below the surface of Frenchman Flat, a dry lake bed, which led to the following approximate decay law, according to Perret.

$\delta = \delta_0 \exp(-0.017D)$,

where δ represents the maximum vertical displacement induced at depth D, δ_0 is the maximum displacement at the surface, and D is the depth in feet.

18th April, 1950.

Sir,

Civil Defence Act, 1948
Regulations relating to the Evacuation of the
Civil Population (Statutory Instrument 1949, No.2147)

1. I am directed to refer to Circular 81/49 (Wales) of 23rd August, 1949, which transmitted for your information a copy of the draft Civil Defence (Evacuation and Care of the Homeless) Regulations, 1949. These Regulations have now been approved by both Houses of Parliament and are now operative. I am now to enclose a copy of a Memorandum on Evacuation (Memo Ev.1 (1950) which contains an outline of the general plan for the transfer of certain sections of the civilian population from the more densely populated areas in the event of war or the imminence of war. For the purpose of this transfer the system developed in the 1939/45 war has been adopted, whereby the country is divided into evacuation, neutral and reception areas

9. **ESTIMATES OF ACCOMMODATION IN RECEPTION AREAS**

In order that specific allocations may be worked out and each Reception Authority informed of the number of members of the priority classes for whom their plans should provide, it is requested that every Reception Authority will prepare an estimate of the total number of habitable rooms in their area. The Minister of Health has been advised by the Associations of Local Authorities that the Receptio Authorities (who are the Housing Authorities) will be able to make reasonably accurat estimates from information already available to them. The estimate should include all rooms normally used in the locality either as living rooms or as bedrooms. I am to ask that this estimate may be forwarded to the Department, not later than 30th June, 1950.

10. The Department do not consider that any useful purpose would be served by carrying out at this stage a detailed survey of the accommodation which could be made available for evacuees such as was undertaken in January, 1939.

IV. LATER ACTION

11. When the specific allocations of the number of members of the priority classes for whose reception arrangements should be made in each reception area have been decided, it will be possible to link each Reception Authority with a particular Evacuation Authority. When the plan has been developed in this way, or as the

---

14. The Memorandum on Evacuation (Memo Ev.1 (1950) has been placed on sale. Further copies may be purchased direct from His Majesty's Stationery Office or from any bookseller.

I am, Sir,
Your obedient Servant,

William Thomas

The Clerk of the Council.

Appendix for Group

LINKING OF EVACUATION AND RECEPTION AREAS FOR ORGANISED EVACUATION

MERSEYSIDE GROUP

EVACUATION AREAS

Liverpool C.B.	Bebington B.
Birkenhead C.B.	Widnes B.
Wallasey C.B.	Litherland U.D.
Bootle C.B.	Northwich U.D.
Crosby B.	Runcorn U.D.
	Ellesmere Port U.D.

Estimated Civil Population, 1,320,000 *

Estimated number of members of priority classes, 376,300

ASSOCIATED RECEPTION AREAS

County	Local Authority	Estimated Civil Population *
Cheshire	Chester C.B.	48,000
	Alsager U.D.	5,000
	Hoole U.D.	9,000
	Hoylake U.D.	26,000
	Middlewich U.D.	6,000
	Nantwich U.D.	9,000
	Neston U.D.	9,000
	Sandbach U.D.	9,000
	Winsford U.D.	12,000
	Wirral U.D.	17,000
	Chester R.D.	19,000
	Nantwich R.D.	26,000
	Tarvin R.D.	15,000
	Total	210,000
Lancashire	Blackpool C.B.	152,000
	Southport C.B.	84,000
	Colne B.	20,000
	Fleetwood B.	26,000
	Nelson B.	34,000
	Adlington U.D.	4,000
	Barrowford U.D.	5,000
	Brierfield U.D.	7,000
	Formby U.D.	9,000
	Kirkham U.D.	4,000
	Ormskirk U.D.	21,000
	Padiham U.D.	10,000
	Poulton le Fylde U.D.	8,000
	Preesall U.D.	2,000
	Skelmersdale U.D.	6,000

* Registrar-General's estimate of civil population as at mid-1948.

ASSOCIATED RECEPTION AREAS (Contd.)

County	Local Authority	Estimated Civil Population *
Cardigan	Aberystwyth B.	10,000
	Cardigan B.	3,000
	Lampeter B.	2,000
	Aberayron U.D.	1,000
	New Quay U.D.	1,000
	Aberayron R.D.	9,000
	Aberystwyth R.D.	10,000
	Teifiside R.D.	10,000
	Tregaron R.D.	5,000
	Total	51,000
Denbigh	Colwyn Bay B.	23,000
	Denbigh B.	8,000
	Ruthin B.	4,000
	Wrexham B.	29,000
	Abergele U.D.	7,000
	Llangollen U.D.	3,000
	Llanrwst U.D.	3,000
	Aled R.D.	7,000
	Ceiriog R.D.	7,000
	Hiraethog R.D.	5,000
	Ruthin R.D.	10,000
	Wrexham R.D.	62,000
	Total	168,000
Flint	Flint B.	14,000
	Buckley U.D.	8,000
	Connah's Quay U.D.	7,000
	Holywell U.D.	8,000
	Mold U.D.	6,000
	Prestatyn U.D.	8,000
	Rhyl R.D.	19,000
	Hawarden R.D.	32,000
	Holywell R.D.	22,000
	Overton R.D.	6,000
	St. Asaph R.D.	8,000
	Total	138,000
Merioneth	Bala U.D.	1,000
	Barmouth U.D.	2,000
	Dolgelley U.D.	2,000
	Festiniog U.D.	7,000
	Towyn U.D.	3,000
	Deudraeth R.D.	7,000
	Dolgelley R.D.	8,000
	Edeyrnion R.D.	4,000
	Penllyn R.D.	3,000
	Total	37,000

1939 British Government Evacuation Leaflet.

PUBLIC INFORMATION
LEAFLET NO. 3

Read this and
keep it carefully.
You may need it.

1.5 million people were evacuated by train from cities. Another 2 million privately evacuated cities.

British Government evacuation plans began in 1931, 8 years before war. 75% of Manchester's children were evacuated, compared to just 15% in Sheffield where civil defence was dismissed as propaganda by Labour council members in charge.

EVACUATION

WHY AND HOW?

WHY EVACUATION?

There are still a number of people who ask " What is the need for all this business about evacuation? Surely if war comes it would be better for families to stick together and not go breaking up their homes?"

It is quite easy to understand this feeling, because it is difficult for us in this country to realise what war in these days might mean. If we were involved in war, our big cities might be subjected to determined attacks from the air—at any rate in the early stages—and although our defences are strong and are rapidly growing stronger, some bombers would undoubtedly get through.

We must see to it then that the enemy does not secure his chief objects—the creation of anything like panic, or the crippling dislocation of our civil life.

One of the first measures we can take to prevent this is the removal of the children from the more dangerous areas.

THE GOVERNMENT EVACUATION SCHEME

The Government have accordingly made plans for the removal from what are called " evacuable " areas (see list at the back of this leaflet) to safer places called " reception " areas, of school children, children below school age if accompanied by their mothers or other responsible persons, and expectant mothers and blind persons.

The scheme is entirely a voluntary one, but clearly the children will be much safer and happier away from the big cities where the dangers will be greatest.

There is room in the safer areas for these children; householders have volunteered to provide it. They have offered homes where the children will be made welcome. The children will have their schoolteachers and other helpers with them and their schooling will be continued.

WHAT YOU HAVE TO DO

Schoolchildren

Schoolchildren would assemble at their schools when told to do so and would travel together with their teachers by train. The transport of some 3,000,000 in all is an enormous undertaking. *It would not be possible to let all parents know in advance the place to which each child is to be sent but they would be notified as soon as the movement is over.*

If you have children of school age, you have probably already heard from the school or the local education authority the necessary details of what you would have to do to get your child or children taken away. *Do not hesitate to register your children under this scheme, particularly if you are living in a crowded area.* Of course it means heartache to be separated from your children, but you can be quite sure that they will be well looked after. That will relieve you of one anxiety at any rate. You cannot wish, if it is possible to evacuate them, to let your children experience the dangers and fears of air attack in crowded cities.

Children under five

Children below school age must be accompanied by their mothers or some other responsible person. Mothers who wish to go away with such children should register with the Local Authority. *Do not delay in making enquiries about this.*

A number of mothers in certain areas have shown reluctance to register. Naturally, they are anxious to stay by their menfolk. Possibly they are thinking that they might as well wait and see; that it may not be so bad after all. *Think this over carefully and think of your child or children in good time.* Once air attacks have begun it might be very difficult to arrange to get away.

Expectant Mothers

Expectant mothers can register at any maternity or child welfare centre. For any further information inquire at your Town Hall.

The Blind

In the case of the Blind, registration to come under the scheme can be secured through the home visitors, or enquiry may be made at the Town Hall.

The invasion of France in 1940 led to evacuation of children on the East and South coasts to Wales, in preparation for invasion defences. Efforts to evacuate kids to Canada ended when 77 were killed when the City of Benares was sunk by submarine U-48 on 18 September 1940.

Northampton Independent 8.9.39.

THEY are here. They have settled down. Northamptonshire's population has increased by 39,000 with the arrival of evacuees from the vulnerable districts of London, writes an "Independent" representative.

Young children showed a brave exterior and declined to succumb to the emotional pangs of homesickness.

Northampton people with prodigious sympathy have recognised and appreciated the inner feelings of these little children and others being ruthlessly torn from their homes through the unknown contingencies of war; torn from their cherished belongings, their parents and relatives.

PRIVATE ARRANGEMENTS

If you have made private arrangements for getting away your children to relatives or friends in the country, or intend to make them, you should remember that while the Government evacuation scheme is in progress ordinary railway and road services will necessarily be drastically reduced and subject to alteration at short notice. Do not, therefore, in an emergency leave your private plans to be carried out at the last moment. It may then be too late.

If you happen to be away on holiday in the country or at the seaside and an emergency arises, do not attempt to take your children back home if you live in an " evacuable " area.

WORK MUST GO ON

The purpose of evacuation is to remove from the crowded and vulnerable centres, if an emergency should arise, those, more particularly the children, whose presence cannot be of any assistance.

Everyone will realise that there can be no question of wholesale clearance. We are not going to win a war by running away.

Most of us will have work to do, and work that matters, because we must maintain the nation's life and the production of munitions and other material essential to our war effort. For most of us therefore, who do not go off into the Fighting Forces our duty will be to stand by our jobs or those new jobs which we may undertake in war.

Some people have asked what they ought to do if they have no such definite work or duty.

You should be very sure before deciding that there is really nothing you can do. There is opportunity for a vast variety of services in civil defence. YOU must judge whether in fact you can or cannot help by remaining. If you are sure you cannot, then there is every reason why you should go away if you can arrange to do so, but you should take care to avoid interfering with the official evacuation plans. If you are proposing to use the public transport services, make your move either BEFORE the evacuation of the children begins or AFTER it has been completed. You will not be allowed to use transport required for the official evacuation scheme and other essential purposes, and you must not try to take accommodation which is required for the children and mothers under the Government scheme.

For the rest, we must remember that it would be essential that the work of the country should go on. Men and women alike will have to stand firm, to maintain our effort for victory. Such measures of protection as are possible are being pushed forward for the large numbers who have to remain at their posts. That they will be ready to do so, no one doubts.

The " evacuable " areas under the Government scheme are:—
(*a*) London, as well as the County Boroughs of West Ham and East Ham; the Boroughs of Walthamstow, Leyton, Ilford and Barking in Essex; the Boroughs of Tottenham, Hornsey, Willesden, Acton, and Edmonton in Middlesex; (*b*) the Medway towns of Chatham, Gillingham and Rochester; (*c*) Portsmouth, Gosport and Southampton; (*d*) Birmingham and Smethwick; (*e*) Liverpool, Bootle, Birkenhead and Wallasey; (*f*) Manchester and Salford; (*g*) Sheffield, Leeds, Bradford and Hull; (*h*) Newcastle and Gateshead; (*i*) Edinburgh, Rosyth, Glasgow, Clydebank and Dundee.

In some of these places only certain areas will be evacuated. Evacuation may be effected from a few other places in addition to the above, of which notice will be given.

Issued from the Lord Privy Seal's Office July, 1939

Herald 28/11/39 P.7

15 BOYS—BANG GO THE CHAIRS

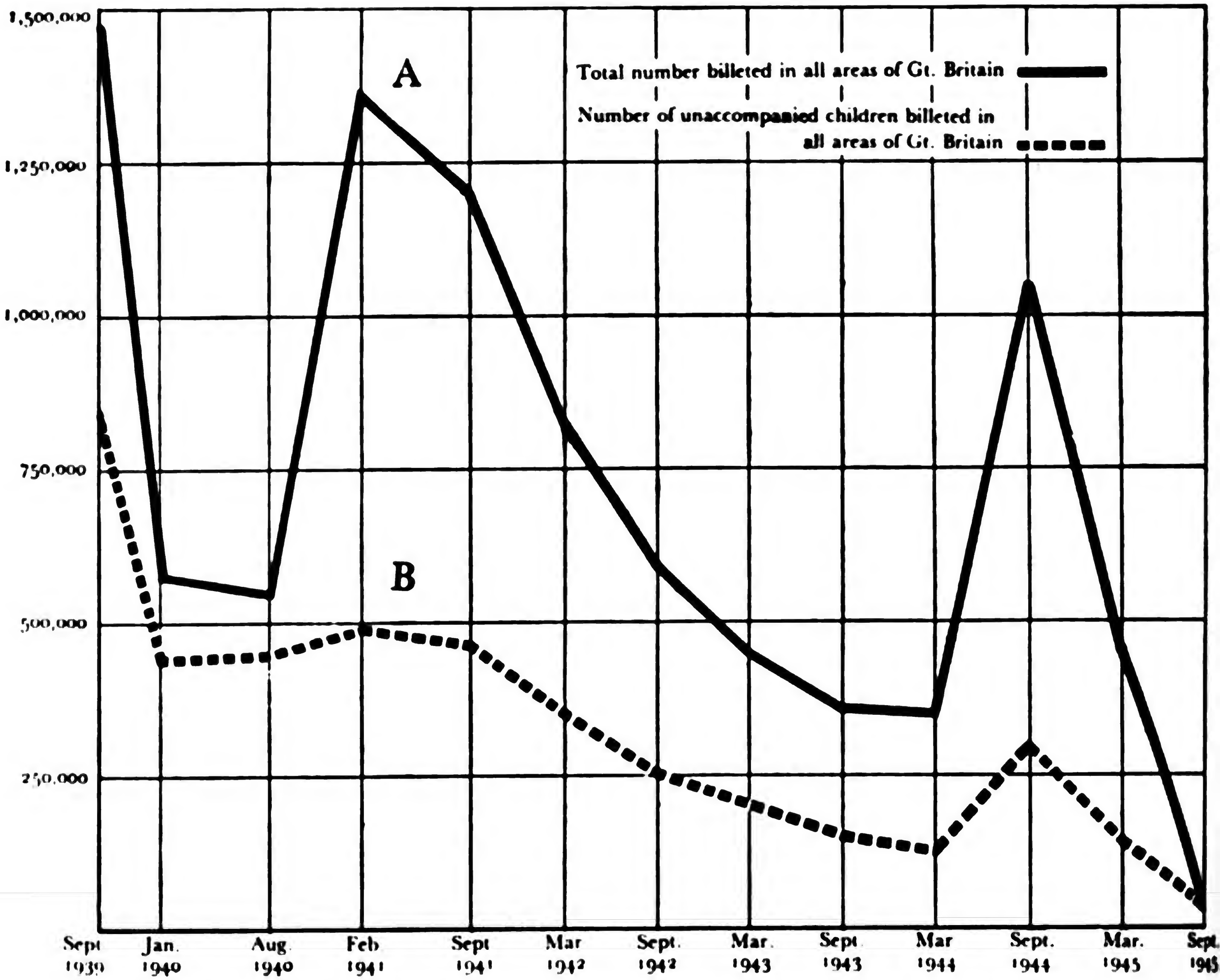
MRS. MAY WELCH, of Beaconsfield Villas, Brighton, has so many children she doesn't know what to do.

But, unlike those of the Old Lady Who Lived in a Shoe, they are not her own. They are evacuees.

She has fifteen—all boys.

"And I can't cope with them," she told the magistrate yesterday when she was summoned for showing a light in the black-out.

"It was one of those boys," she explained. "He took a candle into an empty room."



R. Titmuss, 1950, Problems of Social Policy, page 356: "GOVERNMENT EVACUATION SCHEME 1939–45. The accompanying diagram depicts the important phases in the history of evacuation. Line A represents the total number of persons billeted or otherwise accommodated under Government authority and includes, as well as mothers and children, teachers, helpers, the aged and infirm, homeless people and other assisted groups. Line B picks out only the unaccompanied children."

Use of voluntary services to train civil defence in first aid, etc., prior to WWII:

Under the impact of the emergency there was a rush to acquire first-aid knowledge, which profoundly affected the Association. Certificates issued in 1937 totalled over 48,000. In the peak year of 1940, the number rose to over 298,000.

Class instruction became a major matter. The Government, through air-raid precautions, invited the Association and the Red Cross to train Civil Defence personnel in first-aid and anti-gas measures. . . .

Numerically, the Brigade rose. At the end of 1938 the adult strength was just over 55,000 men and 17,000 women. A year later the figures read: 72,000 men and 31,000 women.

- Joan Clifford, "A Good Uniform: The St John [Ambulance Association] Story", London, 1967

First aid in an underground shelter during World War II.

British Ministry of Health 1939 poster about evacuation: on Friday 1 September 1939, Hitler's Nazis invaded Poland. This IMMEDIATELY triggered Operation Pied Piper, the evacuation of children from cities, PRIOR to Britain declaring war on 3 September 1939!

Where a woman's help is needed

VOLUNTEER FOR THE

Welfare Section

C D

CIVIL DEFENCE CORPS

Ask at your Council Offices


CIVIL DEFENCE
WOMEN WANTED FOR
EVACUATION SERVICE

Effectiveness of Some Civil Defense Actions in Protecting Urban Populations (u)

Appendix B of Defense of the US against Attack by Aircraft and Missiles (u)

ORO-R-17, Appendix B

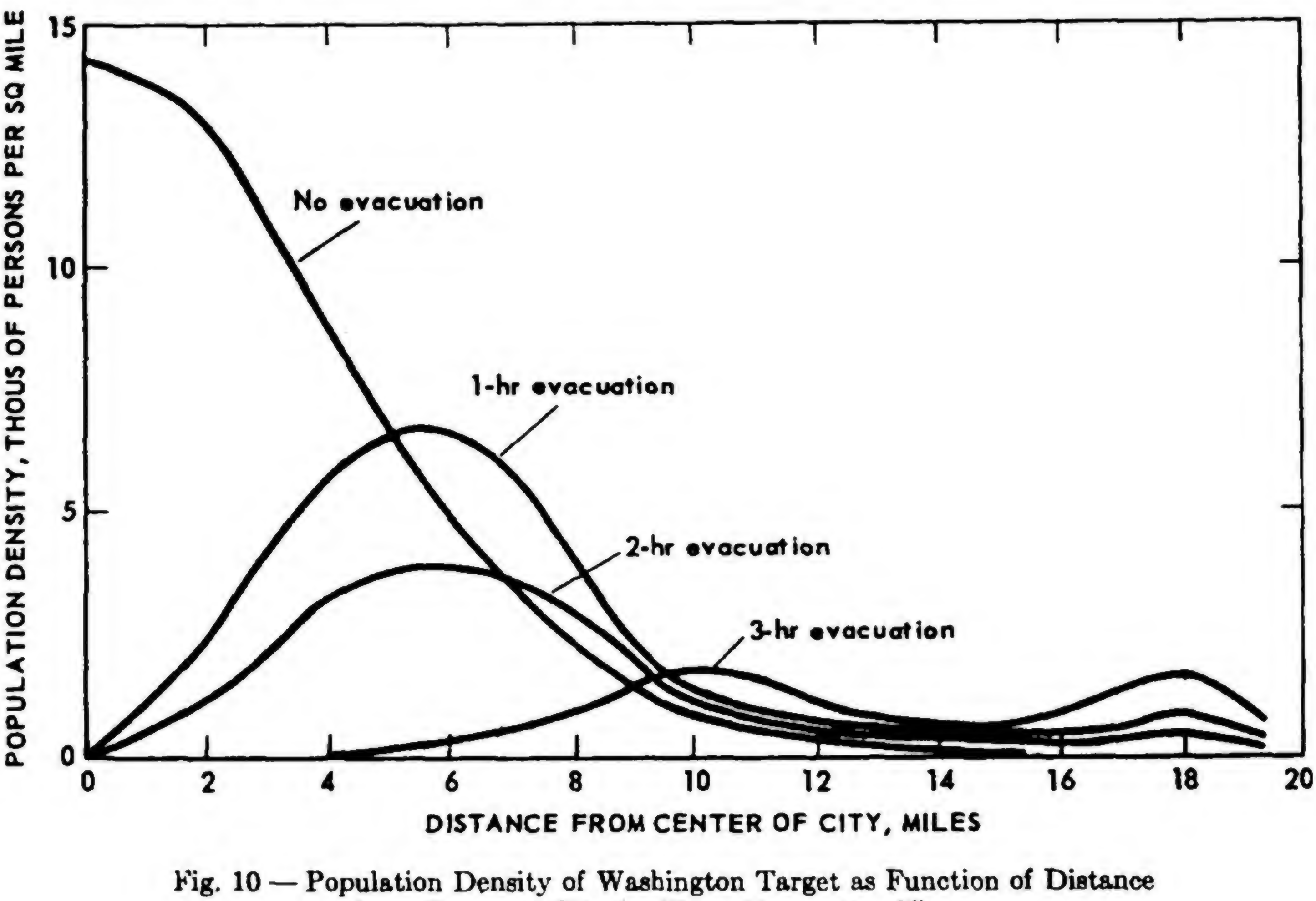


Fig. 10 — Population Density of Washington Target as Function of Distance from Center of City for Three Evacuation Times

THE A.F.S. THE AUXILIARY FIRE SERVICE

A firewoman takes down a message for transmission by "Walkie-Talkie."

AUXILIARY FIREWOMEN are trained to do the same jobs as regular firewomen. They learn organisation and administration, the control and mobilising of fire appliances and how to operate V.H.F. radio. They may be drivers or crews of mobile controls or canteen vans.

THE NUMBER OF ATOMIC BOMBS EQUIVALENT TO THE LAST WAR AIR ATTACKS ON GREAT BRITAIN AND GERMANY

UK National Archives HO 225/16, 30 January 1950, Top Secret

Summary

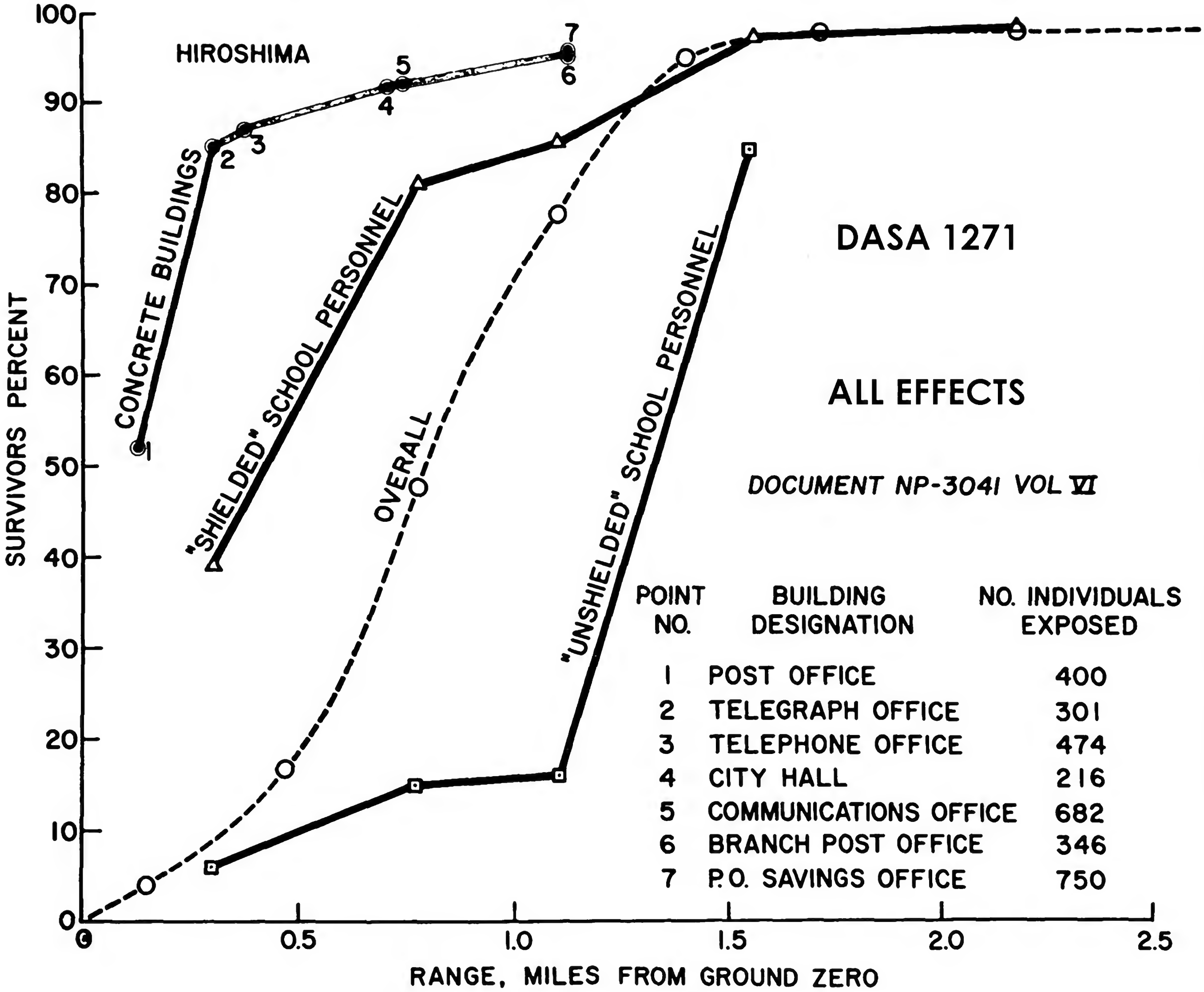
(UK Home Office Scientific Advisory Branch)

During the last war, a total of 1,300,000 tons* of bombs were dropped on Germany by the Strategic Air Forces. If there were no increase in aiming accuracy, then to achieve the same total amount of material damage (to houses, industrial and transportation targets, etc.) would have required the use of over 300 atomic bombs together with some 500,000 tons of high explosive and incendiary bombs for targets too small to warrant the use of an atomic bomb.

This figure for the weight of H.E. equivalent to the atomic bomb for causing casualties increases as the amount of protection of the population increases. Thus for the night raiding conditions on London in the last war, where something like 60% of the population were in houses, 35% in shelter and 5% in the open, the number killed in inner London per ton

of bombs was about 4. For corresponding conditions of exposure it is considered that the deaths from an atomic bomb would be of the order of 25,000, giving an H.E. equivalent of just over 6,000 tons. Taking, therefore, 6,000 tons as the average equivalent for last war conditions of exposure in this country, we get that the 75,000 tons of bombs dropped by the German Air Force were equivalent for causing casualties to about 12 atomic bombs dropped with the accuracy actually achieved by the G.A.F., or to about 3 atomic bombs accurately placed at the centres of big cities.

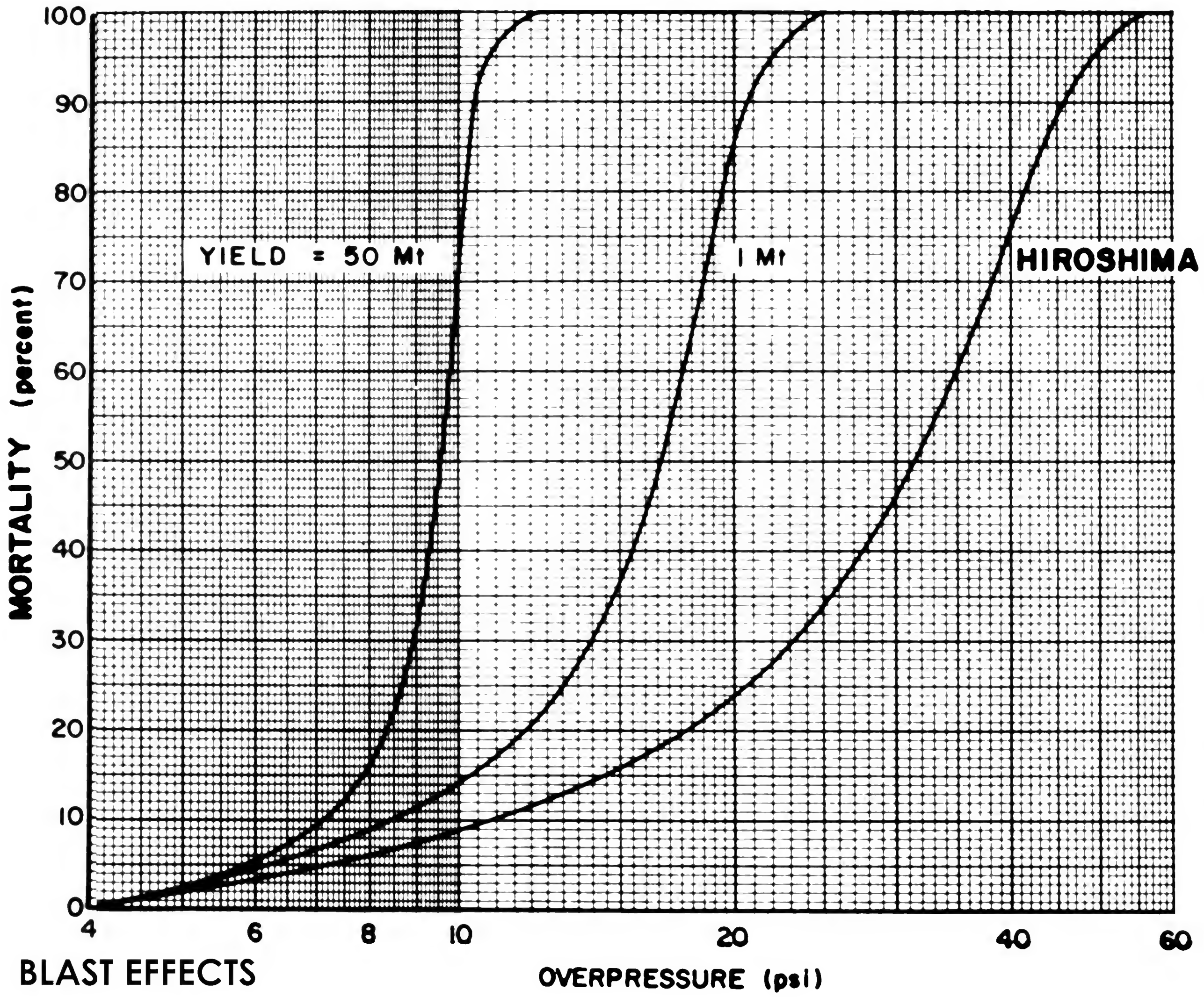
a much greater total area of damage would be achieved by splitting the mass up and having a number of small explosions rather than one very large explosion. This, of course, is what happened in air attacks with high explosive bombs in the last war.



Ashley W. Oughterson, et al., Medical Effects of Atomic Bombs, NP-3036 to NP-3041 (Vols. I-VI), Army Institute of Pathology; 1951.

DC-P-1060

NONSEISMIC REINFORCED-CONCRETE BUILDINGS



L. Wayne Davis, Donald L. Summers, William L. Baker, and James A. Keller, Prediction of Urban Casualties and the Medical Load from a High-Yield Nuclear Burst, DC-FR-1060, The Dikewood Corporation

BLAST EFFECTS

CD 2333

~~SECRET~~

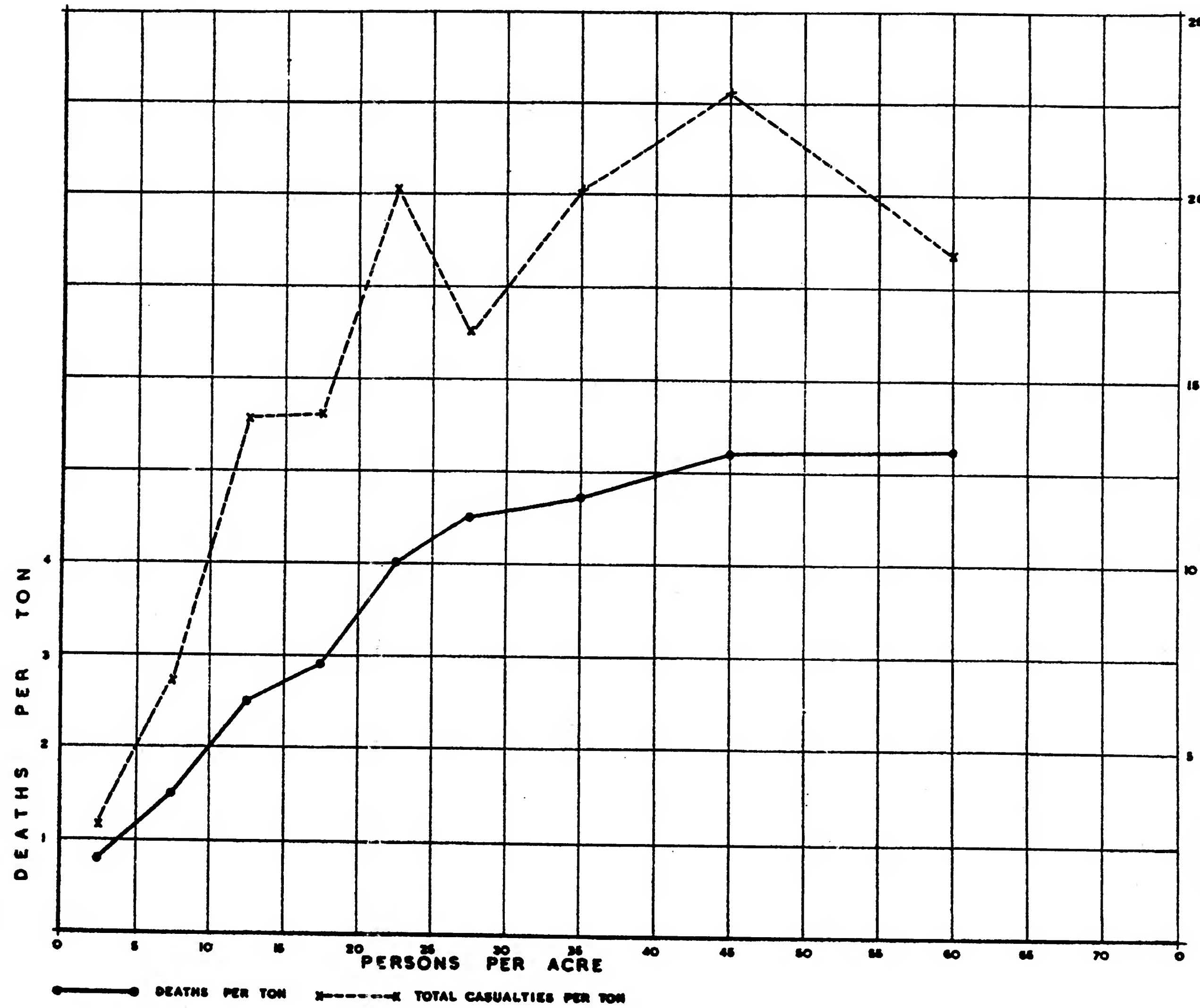
HOME OFFICE

CD/SA 12
Copy. No 5.

OFFICE OF THE CHIEF SCIENTIFIC ADVISER

A COMPARISON BETWEEN THE NUMBER OF PEOPLE KILLED PER TONNE OF BOMBS DURING WORLD WAR I AND WORLD WAR II

FIG I DENSITY OF POPULATION AND CASUALTIES PER TON OF H.E'S. & MINES IN LONDON REGION IN JANUARY TO MAY 1941



BOMB SIZES

=> ≈ 175 kg

For World War II the average bomb weight was between 150 - 200 kg. (R.C. 268, Table 6), whereas for World War I the majority of bombs were 12 or 50 kg. It is known that in World War II the smaller bombs (50 kg.) certainly did not cause fewer deaths per tonne than the larger bombs. Thus on size alone we should expect a higher death rate in World War I if anything.

For the country as a whole the death rate per tonne for World War I was 5.8 times that for World War II. When the comparison is reduced to comparable areas (roughly the county of London) this factor is reduced to 4.25. Differences in population density in the two wars are shown to account for a factor of nearly 2 and differences in exposure for a further factor of 1.5 to 2.

Total casualties include killed and injured

TABLE 1

Casualty rates per tonne for all bombs dropped during the two wars

	Tonnes dropped		Killed		Killed/ tonne		Total / casualties		Casualties/ tonne	
	14/18	39/45	14/18	39/45	14/18	39/45	14/18	39/45	14/18	39/45
Whole country	301.8	74,900	1,414	60,595	4.7	.81	4,830	146,777	16.0	1.96
London	62.8	14,800	670	30,300	10.7	2.02	2,630	80,000	41.8	5.41
Remainder	239.0	60,100	744	30,300	3.1	.50	2,200	66,700	9.2	1.11

TABLE 2

Killed rates, London County, for both wars

	Tonnes dropped	Killed	Killed/ tonne
1915/17	19.6	349	17.8
1939/45	3591	15,171	4.2

POPULATION DENSITY

For equal conditions of exposure (i.e. in houses or shelters) it would be expected that the casualties from a bomb would be directly proportional to the density of population round the bomb. This was borne out by the experience of World War II as shown for example in Fig. 1 (taken from R.E.N. 544). It will be seen that deaths per tonne tend to be proportional to population density up to a density of about 25 persons/ acre but that thereafter the rate of increase in death rate with population density is reduced. Two factors might account for this: the greater population densities are associated with greater building densities, and these should provide some measure of shielding, thus reducing the casualty rates. Alternatively in the more densely populated areas more people are known to have gone to shelter, and this again would reduce the casualty rate.

Now in World War I London was more densely populated, and a substantial proportion of the discrepancy between the figures for the two wars is undoubtedly due to this cause.

Mean ratio of densities $\frac{W.W.I}{W.W.II} = 1.94$.

TABLE 5

Relative safeties in World War II deduced from population and casualty distribution

	In the open	Under cover	In shelter
Population exposure	5%	60%	35%
Location people killed	19%	62%	19%
Relative safety	72%	20%	10%

These values are:-

(1) A house about 3½ times as safe as in the open.
(2) A shelter about twice as safe as a house.

TABLE 6

Relation between various population exposures and death rate for World War I compared with known exposure for World War II

	Population exposure			Ratio $\frac{\text{death rates W.W.I}}{\text{" " W.W.II}}$	Location of killed		
	% in open	% in cover	% in shelter		% in open	% in cover	% in shelter
World War II	5	60	35	1	19	62	19
Possible distribution for World War I	10	90	-	1.33	29	71	-
	20	80	-	1.60	48	52	-
	30	70	-	1.88	61	39	-
	40	60	-	2.15	71	29	-

Table 6 also shows the location of killed which is implied by each of the possible population exposures. The only evidence available on this point is that, for the day raid on June 13th, 1916, in which the total number killed was 59, 69.5% of the people killed in the City were in the open. This very limited evidence would imply a ratio of death rates equal to about 2.

It must be remembered that while there were no shelters as such in 1914, basement windows were sandbagged and people encouraged to use them. The tubes were also in use to some extent (Jones' "War in the Air", Vol. V, 109, 134). The information which is available suggests that not more than 3% used shelters. On this basis the assumption of no one in shelter will not appreciably affect the results of Table 6.

Bearing in mind that a day-time public warning system was not introduced until June, 1917 and that the enemy was using a new weapon for which the public was not adequately prepared it is not unreasonable to suppose that a high percentage of people were in the open. The Government of the time actually expressed concern at the public coming into the open when warnings sounded (Jones' "War in the Air", Vol. III, p.179).

CD. 1554.

NOTES ON THE OCCUPANCY OF SHELTERS DURING ATTACK BY V.1 WEAPONS ON LONDON - 1944

For the purposes of the assessment to be carried out by the Civil Defence Joint Planning Staff's Working Party on the effects of a heavy air attack on London it was desirable to obtain some basis for estimating the number of people who might be expected to take shelter in the event of attack by V.1 weapons.

No survey having this particular aim had been carried out but some of the data collected during a survey in the Borough of Wandsworth (1944) to determine the effectiveness of various types of shelter against V.1 attack offered some chance of arriving at a reasonable conclusion. The survey extended over the period 18th June 1944 to 28th August 1944, included approximately 100 incidents and involved the examinations of about 200 Morrison shelters, 700 Anderson shelters, 50 brick surface shelters and also some miscellaneous types. Only shelters within 170 ft. of the explosion were examined and the data is confined to such cases.

Of the 100 incidents investigated by the survey team 57 of them gave rise to reports on 428 Anderson shelters which were accepted for present purposes. The reports cover incidents whenever they occurred in the 24 hours.

The number of people to whom these shelters were accessible amounted to 1,471. The numbers who sheltered or remained in the houses were 853 and 618 respectively. Thus the percentage who took shelter was 58%. These figures confirm a previous estimate based on this data although the method of working could not be traced. The previous estimate referred to was expressed as follows:-

Anderson Shelters:-
Occupancy during daylight hours
(0600 hours to 23.00 hours). 48%.
Occupancy during night hours
69%.

Morrison Shelters:-
Occupancy during daylight hours
69%.
Occupancy during night hours
76%.

Underground Stores + Tunnels.
Tube Stations + Shelters. General. RE/B 62/5/1

....
(R.R. Welch)

10th September 1948

PUBLIC SHELTER OCCUPANCY

21

A12, ~~SD~~

EAST

~~Local~~ Authority	Bunks installed	Occupants On 26/6/44	Occupants On 25/9/44	Public Shelters On dates between 17/12/44 & 7/1/45	
Shoreditch	13,903	5,595	1,598	932	(27/12/44)
Dagenham	3,984	1,000	120	24	(17/12/44)
Hackney	13,467	11,624	4,427	1,535	(22/12/44)
East Ham	3,939	2,078	1,073	874	(18/12/44)
Stepney	22,898	16,915	4,762	3,769	(27/12/44)
Wanstead	2,385	1,819	945	484	(1/1/45)
Leyton	7,144	4,894	1,959	1,471	(18/12/44)
	67,720	43,925	14,884	9,089	

NORTH

Enfield	5,574	1,705	384	64	(20/12/44)
Potters Bar	522	92	63	75	(19/12/44)
Elstree	528	1	nil	nil	(27/12/44)
Friern Barnet	553	387	47	105	(20/12/44)
Islington	17,085	18,676	2,770	2,000	(7/1/45)
Hendon	7,677	2,621	364	223	(18/12/44)
	31,939	23,482	3,628	2,467	

WEST

Staines	1,023	982	88	49	(18/12/44)
Heston	8,178	5,362	987	314	(20/12/44)
	9,201	6,344	1,075	363	

NORTH WEST

Willesden	9,135	4,257	640	371	(18/12/44)
Ruislip	2,631	936	17	nil	(26/12/44)
	11,766	5,193	657	371	

SOUTH

Woolwich	4,929	3,919	1,413	1,457	(18/12/44)
Wandsworth	21,862	17,701	3,876	1,859	(21/12/44)
Southwark	8,871	21,834	5,450	2,789	(22/12/44)
Chislehurst Caves	10,000	10,000	1,846	1,800	(3/1/44)
	45,662	43,454	12,585	7,905	
Total	166,288	122,398	32,829	20,195	
	Capacity of bunks used	74%	20%	12%	

PUBLIC SHELTERS (CAVES & TUBES) (UNDERGROUND RAILROAD IN LONDON)

SHELTER USAGE

	Before Fly Bombs	At height of Fly Bombs	Present Time	
Bermondsey	823	11,960	4,780	
Deptford	-	4,429	2,489	
Greenwich	447	3,879	1,615	
Lewisham	209	6,745	2,090	
Woolwich	183	4,926	1,509	
Total Group 4	4,215	31,939	12,483	39%
Barking	163	1,769	694	
Chigwell	6	669	140	
Chingford	-	1,075	227	
Dagenham	-	797	66	
East Ham	300	2,251	1,019	
Ilford	522	3,165	853	
Leyton	-	4,600	1,834	
Waltham Holy Cross	Nil	93	8	
Walthamstow	1,400	3,913	1,708	
Wanstead	104	1,868	621	
West Ham	1,300	8,035	2,974	
Total Group 7		28,235	10,144	36%
Finsbury	-	9,500	1,374	
Holborn	159	4,210	417	
St. Pancras	228	12,700	1,791	
Orpington	-	500	100	
Barnes	Nil	400	100	
Malden & Coombe	-	1,100	100	
Croydon	1,500	9,800	2,290	
Wandsworth	1,050	34,381	3,372	
Coulsdon	-	500	65	
Stepney	-	25,000	7,000	
Total Misc.		98,091	16,609	17%
British Museum	106	565	175	
Kentish Town Disused	65	1,280	440	
Southwark Deep	866	6,042	1,435	
West Ham Tunnel		1,813	520	
West Down "		1,200	385	
Gainsboro' "		1,539	574	
Bethnal Green Tunnel	854	4,170	2,150	
Liverpool Street "	672	930	782	
Aldwych	285	1,346	498	
Deep Shelters (Inner) Total		18,885	6,959	37%
Chislehurst Caves		10,000	1,900	
Surrey Tunnels				
(Riddlesdown	850	1,700	500	
(Brighton Road	Nil	600	20	
(Epsom Downs	Nil	400	25	
(Ashley Road	Nil	250	20	
Deep Shelters (Outer) Total		12,950	2,465	19%
Running Tubes	7,716	73,611	15,968	22%
New Tubes	-	10,727	5,998	56%
		84,338	21,966	26%

15th November, 1944.
Copied 18/12/45 - LH.

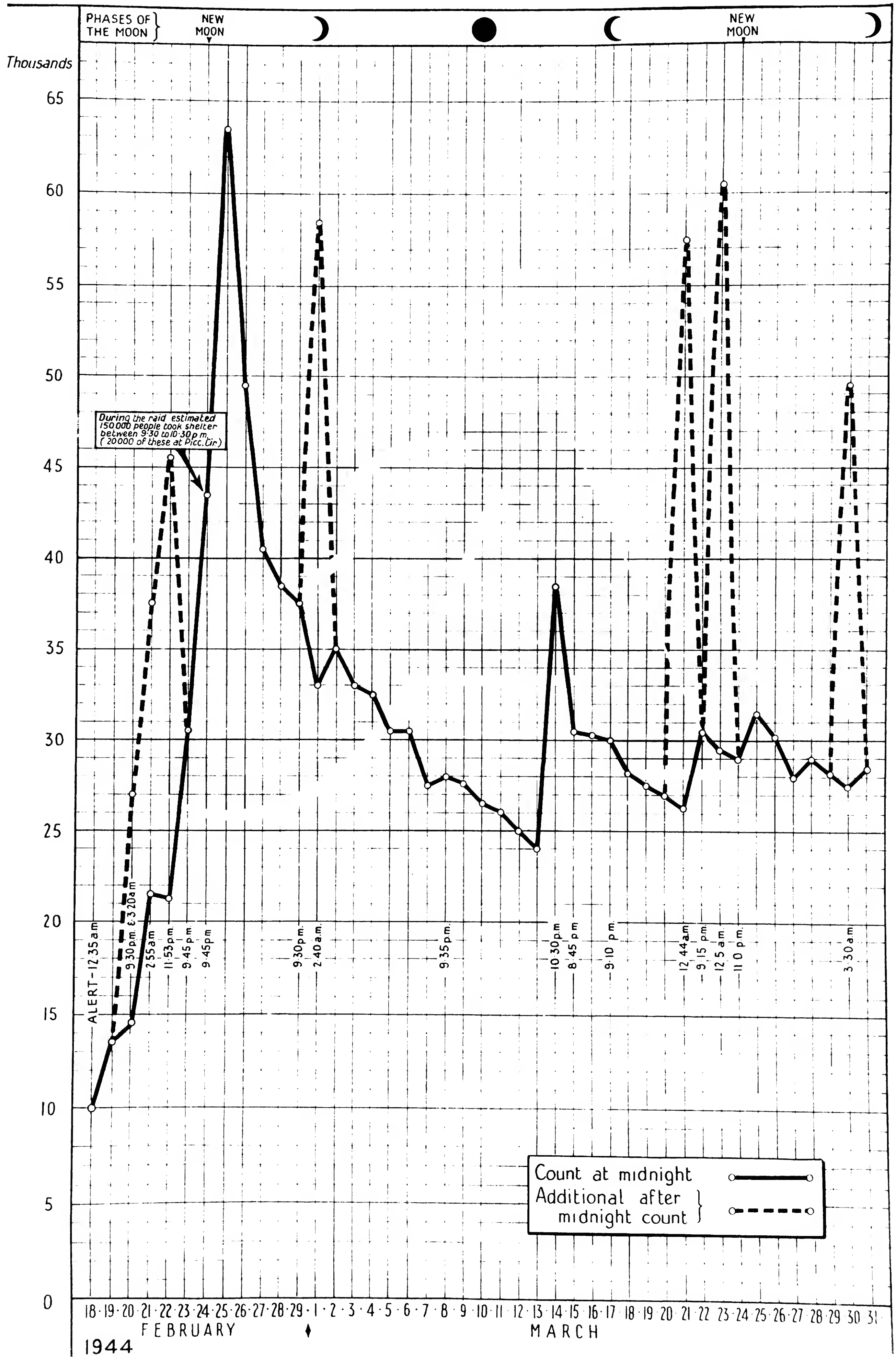
UK National Archives: HO 207/386

NUMBER OF TUBE STATION SHELTERERS

(INCLUDING LIVERPOOL STREET, ALDWYCH AND BETHNAL GREEN)

SECOND BLITZ - FEB. 18th. TO MARCH 31st. 1944

NUMBER OF LONDON ALERTS - 18



~~RESTRICTED~~ For PRO

3 OCTOBER 1963

HOME OFFICE

SCIENTIFIC ADVISER'S BRANCH

CD/SA 116

RESEARCH ON BLAST EFFECTS IN TUNNELS

With Special Reference to the Use of London Tubes as Shelter

by F. H. Pavry

Summary and Conclusions

The use of the London tube railways as shelter from nuclear weapons raises many problems, and considerable discussion of some aspects has taken place from time to time. But - until the results of the research here described were available - no one was able to say with any certainty whether the tubes would provide relatively safe shelter or not.

This research, consisting of a series of model experiments, has demonstrated that the risk from blast in the tubes would be less than the risks above ground. The results are considered to be consistent enough to provide a good estimate of full-scale conditions, and reliable enough to be used as a basis for Home Office shelter policy regarding the London tube railways.

Introduction

When the Advisory Group on Structural Research for Civil Defence was formed in 1957, the Chairman recommended that a study of the effects of blast on tunnels should be one of the main research projects. The relevant paragraphs of his proposals(1) for a research programme were:-

> "In any consideration of tunnels as shelter the crucial problem is the entry of blast, either through existing openings or from a crater formed by a ground-burst bomb. It is particularly important to know if the collapse of a tunnel by earth shock would prevent the blast from entering it, and also whether the collapse would provide a seal against the entry of water from the crater. It is probable that some data could be derived from model experiments using H.E. charges. But it is for consideration whether the results would be so conclusive that the behaviour of full-size tunnels when damaged by megaton weapons could be forecast with the confidence that a major shelter programme would demand."

At the second meeting(2) the Group agreed that model experiments with H.E. charges would be worthwhile, and that the Atomic Weapons Research Establishment (A.W.R.E.) should carry out this research, which has now been accepted by the Advisory Group as successfully completed. A summary record of the progress follows.

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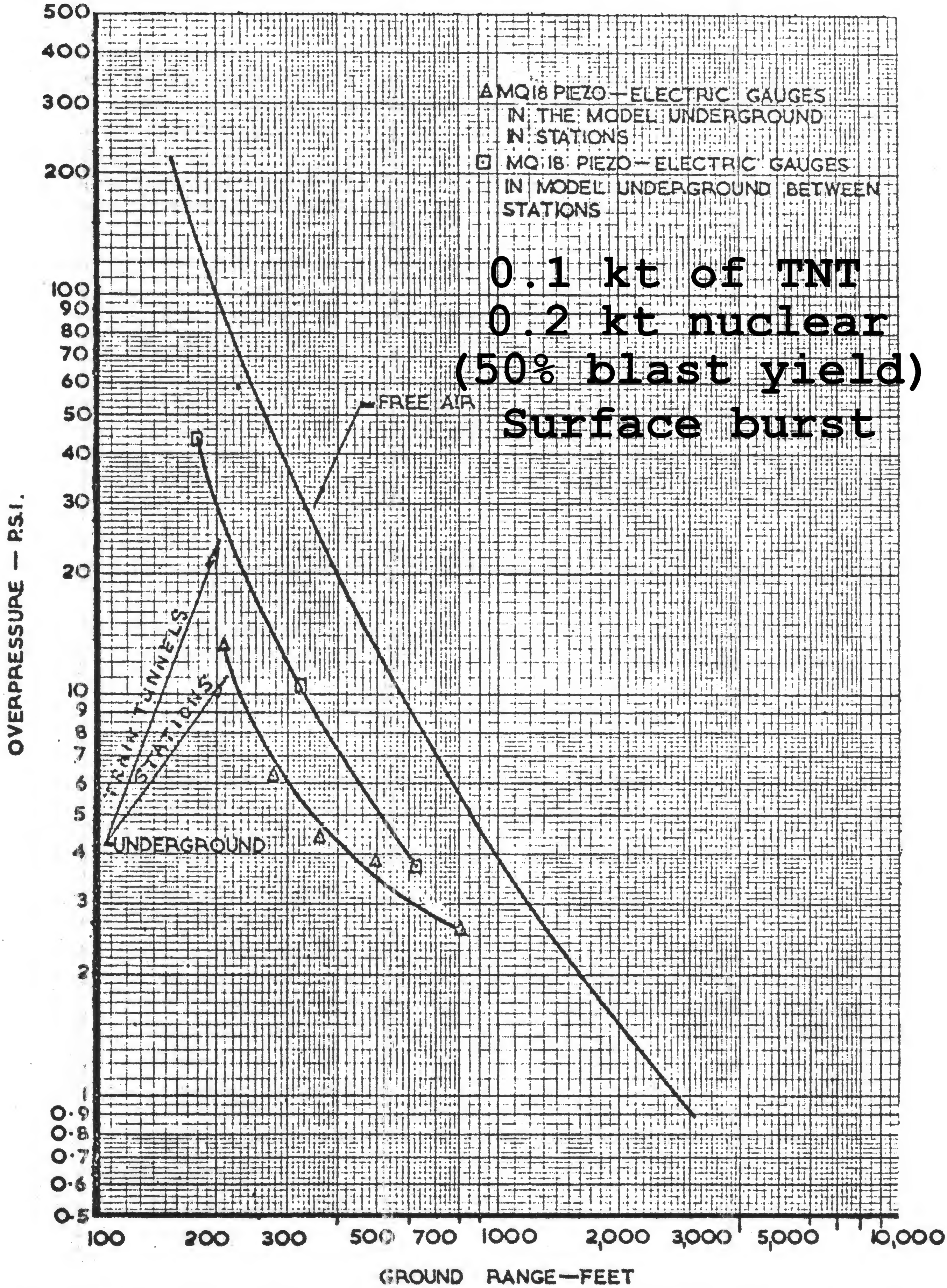
100 ton TNT test on 1000 ft section of London Underground tube at Suffield, Alberta, 3 Aug 1961



Atomic Weapons Research Establishment, "1/40th Scale Experiment to Assess the Effect of Nuclear Blast on the London Underground System", Report AWRE-E2/62, 1962, Figure 30. (National Archives ES 3/57.)

These trials are described in a preliminary report[5] prepared for the Advisory Group by A.W.R.E. It was shown that the blast pressure inside a tunnel system, having openings at intervals to ground level, is less than the pressure at ground level at any distance from the explosion, by a factor of about 3. This reduction in pressure was apparently caused by the station entrances acting as expansion chambers. This observation was of outstanding significance to the consideration of London tubes as shelter.

All previous research on blast in tunnels - and a great amount of work was done on this in the last war - had been conducted with blast entering the open end of a tunnel without side openings. This research had shown that the blast, once it had got into a tunnel, tended to travel great distances without appreciable diminution. This had, therefore, led to the general belief that the London tubes could be death traps rather than shelters.

The more recent research here described showed for the first time that a person sheltering in a tube would be exposed to a blast pressure only about $\frac{1}{3}$ as great as he would be exposed to if he was above ground. (In addition, of course, he would be fully protected from fallout in the tube.)

In fact A.W.R.E. carried out two further tests, with more accurate scaling of station volumes based on more detailed information from the London Transport Executive. A full report on all four tests is in preparation.

These later tests showed that the pressure in station tunnels was only about $^1/6$th of the ground-level pressure, but that the reduction was not so great in the smaller-diameter train tunnels.

At this stage the Advisory Group were reasonably satisfied that this problem - of blast entry from stations - had been solved. But the other major question of blast entry direct from the crater remained in doubt, on account of the very small scale of the tests to date. Therefore, when the opportunity arose of testing at a really large scale at Suffield, Canada, it was naturally accepted.

<u>Large-Scale Field Test ($^1/40$) at Suffield, Alberta</u>

The test is fully described in an A.W.R.E. report[6]. The decision of the Canadian Defence Research Board to explode very large amounts of high explosive provided a medium for a variety of target-response trials that was welcome at a time when nuclear tests in Australia were suspended. A.W.R.E. used the 100-ton explosion in 1961 to test, among other items, the model length of the London tube, at $^1/40$th scale, that had already been tested at $^1/117$ scale.

<u>Blast Entry from Stations</u>

There was remarkable agreement with the $^1/117$th scale trials: "maximum overpressure in the train tunnels was of the order of $\frac{1}{3}$rd the corresponding peak shock overpressure in the incident blast. The pressures in the stations were about $^1/6$th those in the corresponding incident blast .... ". In comparing the results at the two scales it was noted that the pressures in the train tunnels (between stations) was higher at Suffield than at the smaller scale; this may, the report suggests, have been due to some blast entry from the crater at Suffield.

Blast Entry from the Crater

There may - as has just been noted - have been some entry of blast at the crater. But the all-important fact is that it was nowhere enough to bring the pressure in the tunnel up to more than a $\frac{1}{3}$rd of the free-air pressure (see fig. 30 reproduced, and attached to this note.) From this, and from a detailed study of tunnel rings ejected by the explosion over a wide area, it can be concluded that the instantaneous crushing of the tube near the crater sealed it against the entry of any significant blast pressure.

Air Flow in Stations

The Report indicates that there would be turbulence generated by blast entry at stations and that there would be a danger to occupants there, on account of blast "windage" acting on them and on missiles that could injure them. This danger would be less in the train tunnels between stations.

Conclusion

The Advisory Group discussed the Suffield Test on tunnels on Nov. 1st 1962, and concluded that model experiments have successfully demonstrated that the risks from blast inside the London tubes would be less than above ground. The Group considered that the results obtained were consistent enough to provide as good an estimate of full-scale effects from megaton weapons as was likely to be obtainable, and that the Chairman could advise the Home Office confidently on the basis of these results. The Group accepted that there would be a risk of casualty-producing air flow in stations, but decided to defer a decision on whether further research on this problem would be profitable. The Chairman said that he would first convey the results of the completed research to the Shelter Division of the Home Office before asking the Group whether it was worth studying this remaining, but less important, problem.

3rd October, 1963.

References

(1) Advisory Group on Structural Research for Civil Defence

Note by Chairman on the Structural Research Programme for Shelters. SAB/SG(57)6. (Restricted)

(2) Notes of Meeting on 15th May 1957. SAB/SG(57)2nd Minutes (Confidential)

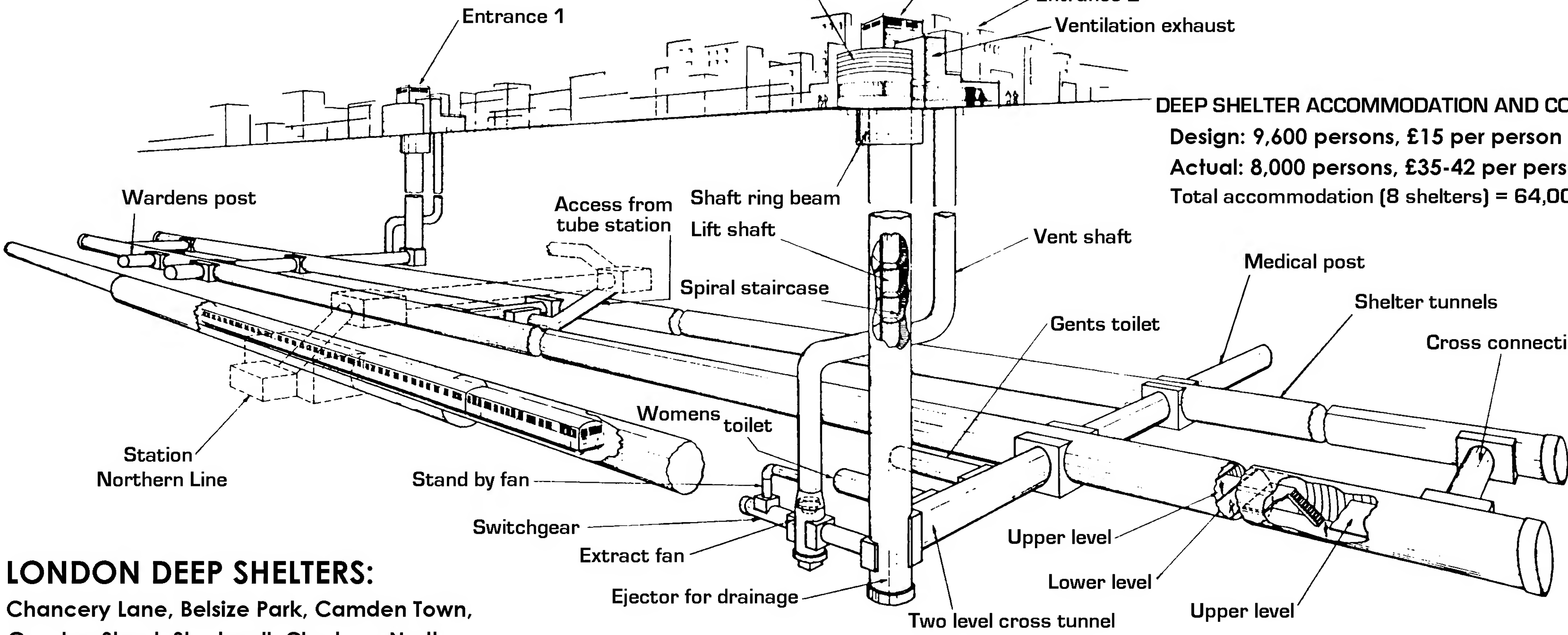
(3) The Entry of Air Blast from Craters into Tunnels. A.W.R.E. Report E1/59 (Official Use Only)

(4) The Effect of Tunnel Blockage on Shock Waves .... SAB/SG(58)6 (Confidential)

(5) Model Experiments on the Entry of Blast into the London Underground System, Interim Report on Rounds 1 and 2. SAB/SG(59)4 (Confidential)

(6) 1/40th Scale Experiment to Assess the Effect of Nuclear Blast on the London Underground System. A.W.R.E. Report E2/62. (Official Use Only.)

UK National Archives: WORK 95/9, 1989-1997,
"Clapham South Deep Tube Shelter: Management"



DEEP SHELTER ACCOMMODATION AND COST

Design: 9,600 persons, £15 per person

Actual: 8,000 persons, £35-42 per person

Total accommodation (8 shelters) = 64,000

LONDON DEEP SHELTERS:

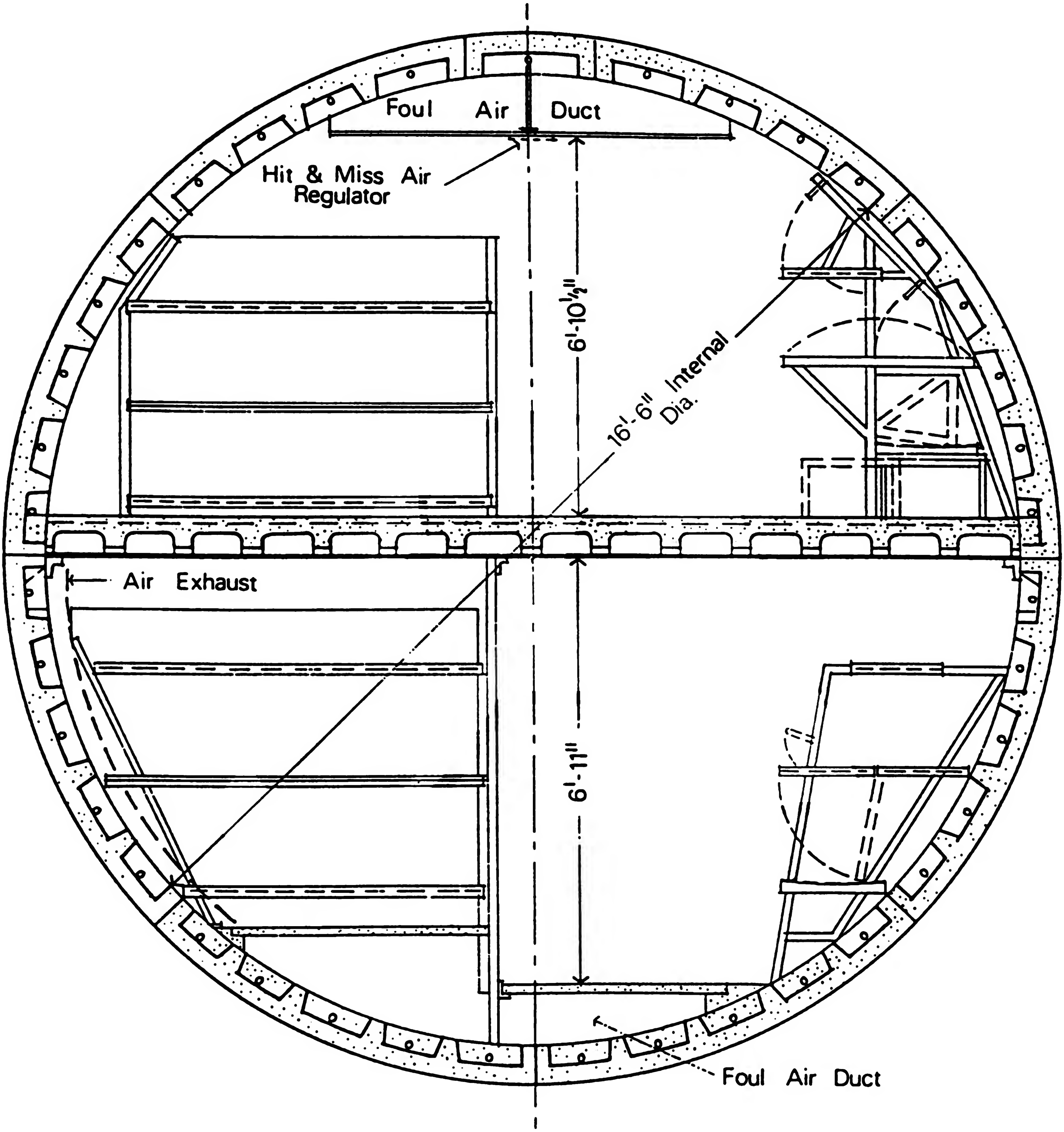
Chancery Lane, Belsize Park, Camden Town, Goodge Street, Stockwell, Clapham North, Clapham Common, Clapham South (government air raid shelters, built in 1940-2)
Building began on 27 November 1940

Deep shelters were used by public from July 1944 after V1 attacks began on 13 June 1944 (V2s began on 8 September)

FIG. 1

MOTT MAY AND ANDERSON
CONSULTING ENGINEERS, LONDON

UK National Archives: WORK 95/9, 1989-1997,
"Clapham South Deep Tube Shelter: Management"



SECTION OF SHELTER TUNNEL

DOMESTIC NUCLEAR SHELTERS

TECHNICAL GUIDANCE

A HOME OFFICE GUIDE

Government bookshops
49 High Holborn, London WC1V 6HB
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Brazennose Street, Manchester M60 8AS
Southey House, Wine Street, Bristol BS1 2BQ
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80 Chichester Street, Belfast BT1 4JY

Government publications are also available through booksellers

Second Edition 1982

Prepared by the Home Office and the Central Office of Information 1981
Printed in England for Her Majesty's Stationery Office by Hobbs the Printers of Southampton

ISBN 0 11 340777 7 (2462) Dd717557 C40 1/82 G381

Introduction

This manual of technical guidance on the design of domestic nuclear shelters has been prepared by a working group set up by the Emergency Services Division of the Home Office. The working group was asked to consider designs of nuclear shelters which could be made available to members of the public in the United Kingdom who might wish to purchase and install shelters for the use of themselves and their families.

The working group realised that the range of designs which it might produce would not be exhaustive. However, it was aware of the need to give technical guidance to professional engineers to assist them in producing reliable shelter designs. Thus the first three chapters of this book are written to give such guidance.

The other four chapters of the book give detailed designs of five shelters. These five cover a range of types which are applicable to different sorts of houses; they also cover a wide price range. These designs are not intended to be exhaustive, and as explained in the text, the working group is already giving attention to other designs, particularly those which might be incorporated into existing or new houses and also underground shelters of shapes other than box-like and using materials other than concrete. It is planned to publish details of this work at a later date.

The members of the working group are:

Mr J C Cotterill, *Chairman*	Scientific Advisory Branch, Home Office
Dr J R Stealey	Scientific Advisory Branch, Home Office
Mr A Lindfield	Scientific Advisory Branch, Home Office
Mr K A Day	F6 Division, Home Office
Mr R W T Haines, C Eng	Directorate of Works, Home Office
Mr H G S Banks, C Eng	Directorate of Works, Home Office
Mr M Connell, C Eng	Directorate of Civil Engineering Services Property Services Agency, Department of Environment
Mr S Bell, C Eng	Directorate of Civil Engineering Services Property Services Agency, Department of Environment
Mr S England, C Eng	Directorate of Mechanical and Electrical Engineering Services Property Services Agency, Department of Environment
Mr I Leys	Atomic Weapons Research Establishment, Ministry of Defence Foulness
Major I C T Ingall	HQ United Kingdom Land Forces Wilton, Wilts.
Mr R Million, *Secretary*	F6 Division, Home Office

Any enquiries concerning this manual should be addressed to the Home Office, F6 Division, and not to individual members of the working group.

To obtain some protection from the heat it is necessary to move out of the direct path of the rays from the fireball; any kind of shade will be of some value. In shelter design, any materials affording protection against ionising radiation or blast will give more than adequate protection against the heat. However it is important to ensure that no exposed parts of the shelter (such as the facings of doors) are made of flammable materials. In the case of shelters made from plastic materials such as GRP (glass reinforced plastic) it is essential that no surfaces should be exposed to the heat pulse. It is unlikely that such plastic materials would catch fire, but they may melt or distort. Since the blast wave follows the heat pulse, such distorted areas may result in lowered blast resistance.

It is considered unlikely that the heat flash from a nuclear explosion would give rise to fire-storms. In the last war, fire-storms were caused in the old city of Hamburg as a result of heavy incendiary attacks and at Hiroshima but not at Nagasaki. A close study of these cities and of German cities where fire-storms did and did not occur revealed several interesting features. A fire-storm occurred only in an area of several square miles, heavily built up with buildings containing plenty of combustible material and where at least every other building in the area had been set alight. It is not considered that the initial density of fires, equivalent to one in every other building, would be caused by a nuclear explosion over a British city. Studies have shown that due to shielding, a much smaller proportion of buildings than this would be exposed to the heat flash. Moreover, the buildings in the centres of most British cities are now more fire-resistant and more widely spaced than they were 30 to 40 years ago. This low risk of fire-storms would be reduced still further by the control of small initial and secondary fires.

2. Shielding for INR

INR has greater energy and penetration than the radiation from fallout. The intensity of both INR and fallout radiation are reduced in proportion to the density of the shielding material. This can be expressed in terms of the 'half-value thickness' which is the thickness of a particular shielding material required to halve the radiation dose-rate. The approximate half-value thicknesses of some shielding materials against INR are given in Fig. 8.

Fig. 8 ***Half-value thicknesses of shielding materials***

	Against INR		Against fallout radiation	
	mm	(inches)	mm	(inches)
Steel	38	(1.5)	18	(0.7)
Concrete	152	(6.0)	56	(2.2)
Earth	190	(7.5)	84	(3.3)
Water	330	(13.0)	122	(4.8)
Brickwork	157	(6.2)	71	(2.8)

3. Slant incidence of INR

Most of the INR from a nuclear explosion arriving at a given point comes in a direct line from the fireball. There is a certain amount of scattering known as 'skyshine' which means that some initial gamma radiation might be received by a person shielded by a barrier from the light and heat flash (see Fig. 10). The amount of scattering of initial gamma radiation depends upon a number of factors, but probably amounts to about 10 per cent of that in the main beam.

Chapter 5
Indoor kit shelter design

"Morrison shelter" of 1941 (indoor steel table shelter)

General

This chapter gives information about an indoor shelter suitable for erection in homes that have basements or rooms that can be converted into a fallout room. It can be used as the 'inner refuge' referred to in the Home Office booklet *Protect and Survive* and anybody considering purchasing or using such a shelter should read *Protect and Survive* and be totally familiar with its contents.

Fig. 65 *Location of shelter*

Indoor kit-type shelter

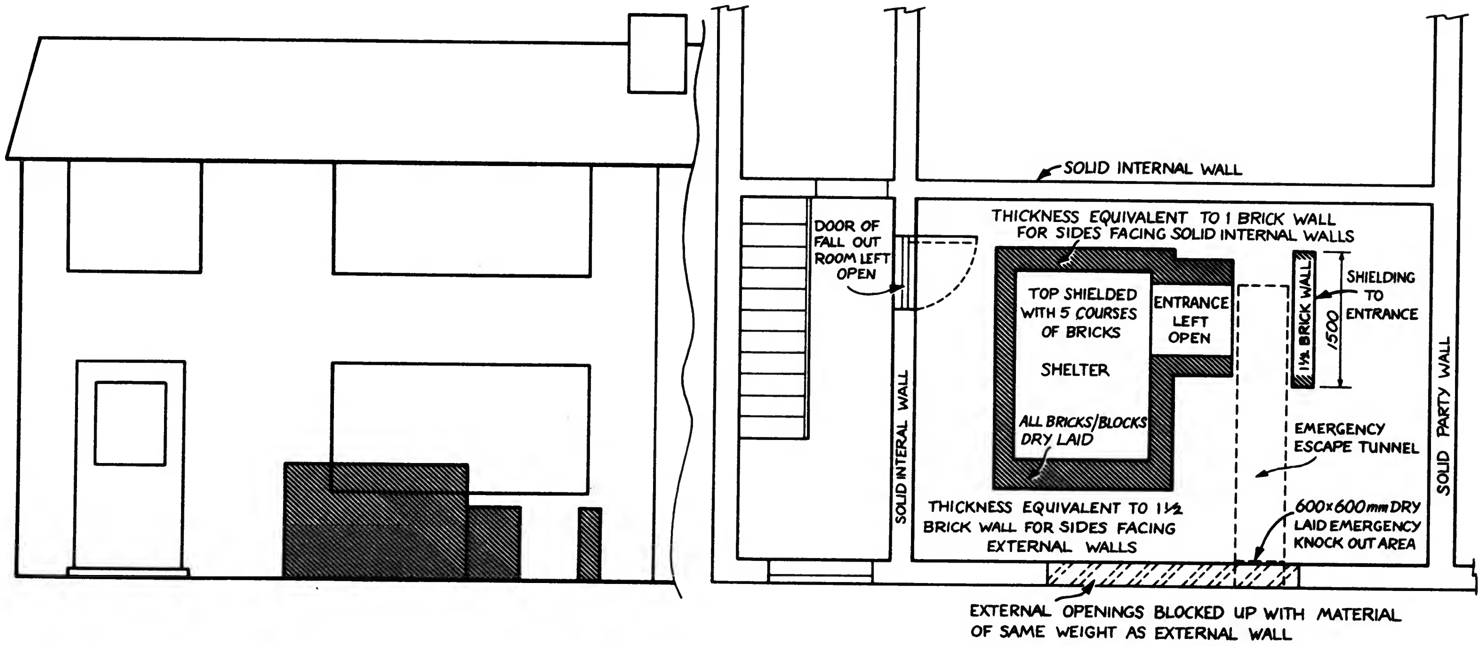

Fig. 67 *Shelter surrounded with sandbags*

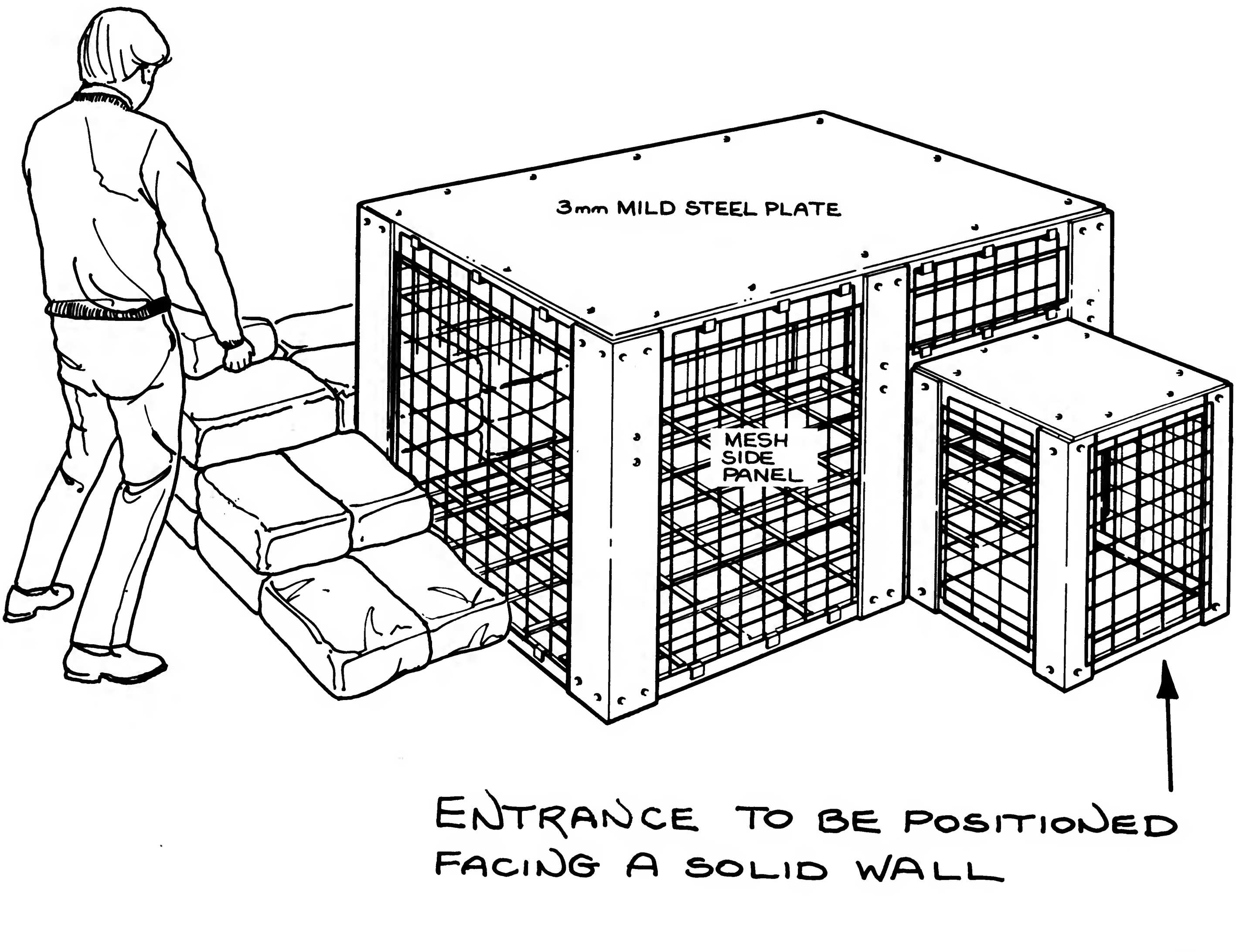

Fig. 12 ***Protective factors of various buildings against initial gamma, neutron and fallout gamma radiation***

Structure	Initial gamma	Neutrons	Fallout gamma
1 metre underground	250–500	100–500	5000
Shelter partly above ground: with 600 mm earth	15–35	12–50	50–200
900 mm earth	50–150	20–100	200–1000

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Considerations arising from the probable attack pattern

In section 1.1.1 reference was made to the fact that an expected attack pattern on the United Kingdom might use 200 megatons on about 80 targets. If we now make an assumption that this attack would be in the form of 100 weapons of 1 MT airbursts and 100 weapons of 1 MT groundbursts we can use the information given in Fig. 6 to indicate the probability of areas being subject to various effects.

On this assumption, we should find that about 2.2 per cent of the land area of the UK would be subject to overpressures in the 'A' ring of 77 kPa (11 psi) and above about 1.8 per cent would be subject to overpressures of between 42 and 77 kPa (6-11 psi) in the 'B' ring and about 10 per cent of the land area would be subject to overpressures of between 10 and 42 kPa (1.5 to 6 psi). The rest of the land area, about 85 per cent, would be subject to blast in the D ring of 5 to 10 kPa (0.75 to 1.5 psi) or to no blast at all. Blast effects in the D ring will cause minor damage to buildings and no lethalities. It is impossible to determine the extent of the total D ring areas since many of these will overlap from adjacent bombs. Any part of the country might be subject to radiation from fallout.

17

Further comments on Home Office shelter designs

Chapters 4 to 7 of this book give details of the Home Office shelter designs and, where appropriate, detailed instructions for construction. It will be useful however to discuss here the reasons why this range of shelters has been chosen. Other designs are under consideration and it is planned to make details of these available later.

Limitations related to houses and gardens

In making recommendations for shelters it has been necessary to keep in mind the varying needs governed by the types of housing in the United Kingdom. Very roughly housing can be divided into the following groups:

a. Detached or semi-detached houses where there is appropriate access to the rear garden. (About 34%).
b. Semi-detached and terrace housing where there is no access to the rear garden, except through the house. (About 20%).
c. Houses with no rear garden. Such houses usually have a passage between the rows of terraces with access to a back yard. (About 25%).
d. Multi-storey blocks of flats. (About 12%).
e. Flats resulting from the conversion of 2, 3 and 4 storey houses. There is usually some garden space available attached to such property. (About 7%).
f. Bungalows, usually with accessible gardens. (About 2%).
g. Caravans.

20

SEPTEMBER 1964

HOME OFFICE

CD/SA 121

SCIENTIFIC ADVISER'S BRANCH

IGNITION AND FIRE SPREAD IN URBAN AREAS FOLLOWING A NUCLEAR ATTACK

G. R. Stanbury

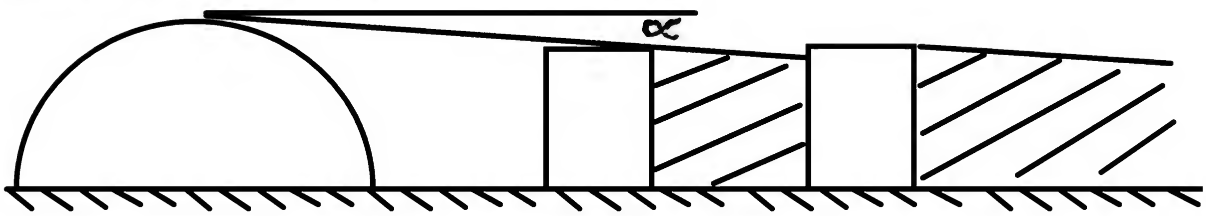
INITIAL FIRE INCIDENCE

For a 1 MT groundburst bomb the height of the top of the fireball above ground is about 0.72 miles. Because this distance is large compared with the height of most buildings, the exposed upper floors do actually see a large part of the fireball and not just the top of it, but in assuming that the radiation is just as intense from the top as from the middle we were overestimating the fire risk.

On the above basis the following table gives the number of exposed upper floors (to the nearest ½ floor) for a range of distances from the explosion and a range of street widths.

Effect of Shielding: Estimation of the number of exposed floors

Assuming that buildings on opposite sides of a street which is receiving heat radiation from a direction perpendicular to its length are of the same height



Distance from explosion miles	Angle of arrival α^{o}	tan α	Width of street (units of 10 ft.)						
			2	3	4	5	6	7	8
1	35	.72	1.5	2	3	3.5	4.5	5	6
1½	26	.48	1	1.5	2	2.5	3	3.5	4
2	20	.36	.5	1	1.5	2	2	2.5	3
3	13½	.24	.5	.5	1	1	1.5	1.5	2
4	10	.18	.5	.5	.5	1	1	1.5	1.5
5	8	.15	.5	.5	.5	.5	1	1	1

we take the average depth of a floor to be 10 ft.

Angle between heat flash and street (degrees)	90-75	75-60	60-45	45-30	30-15	15-0
Proportion of heat flash entering windows %	99	92.5	80	60	40	14

SPREAD OF FIRE

From last war experience of mass fire raids in Germany it was concluded that the overall spread factor was about 2; i.e. about twice as many buildings were destroyed by fire as were actually set alight by incendiary bombs

Number of fires started per square mile in the fire-storm raid on Hamburg, 27th/28th July, 1943

Bombs dropped

102 tons H.E.

88 tons I.B.

48 tons, 4 lb. magnesium

40 tons, 30 lb. gel.

27,000 bombs

3,000 bombs

8,000 bombs on buildings

900 bombs on buildings

1,600 fires

800 fires

100 fires

2,500 fires in 6,000 buildings

However, the important thing to note is that the total number of fires started in each square mile (2,500) was nearly half that of the total number of buildings; in other words, almost every other building was set on fire during the raid itself. When this happened no fire-fighting organisation, however efficient could hope to prevent the fires from joining together and engulfing the whole area.

When the figure of 1 in 2 for the German fire storms is compared with the figures for initial fire incidence of $\sim$ 1 in 15 to 30 obtained in the Birmingham and Liverpool studies it can only be concluded that a nuclear explosion could not possibly produce a fire storm.

Fire situation from 1,499 fly bombs in the built-up part of the London Region

WWII ~~V1~~ high explosives (1 ton TNT warhead) (cruise missiles)

Where dropped	Number of fly bombs	Fly Bombs Caused				
		No fire	Small fire	Medium fire	Serious fire	Major fire
City	119 ~~199~~	47	49	17	4	2
West-End	33	8	22	2	-	1
Closed Residential	430	207	203	20	-	-
Open Residential	804	478	296	28	2	-
Docks	113	64	39	8	1	1
Grand Totals	1,499	804	609	75	7	4

Discussion of results

Two important points emerge from a study of these results:-

(i) The small proportion of fly bombs - less than 20% - which started fires of any greater category than "small" even in the most heavily built-up areas; and

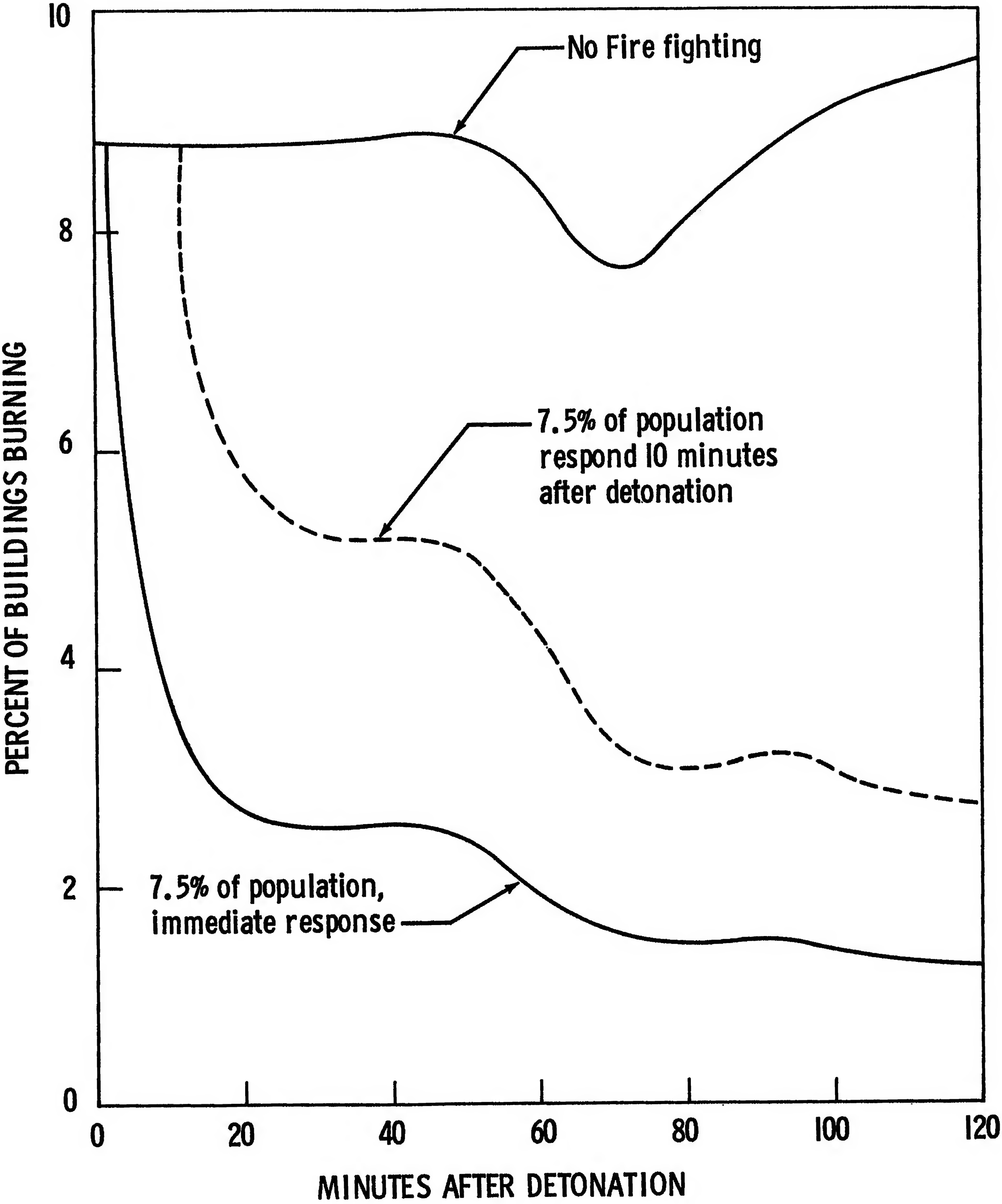
(ii) The large proportion which started no fires at all even in the most heavily built-up areas.

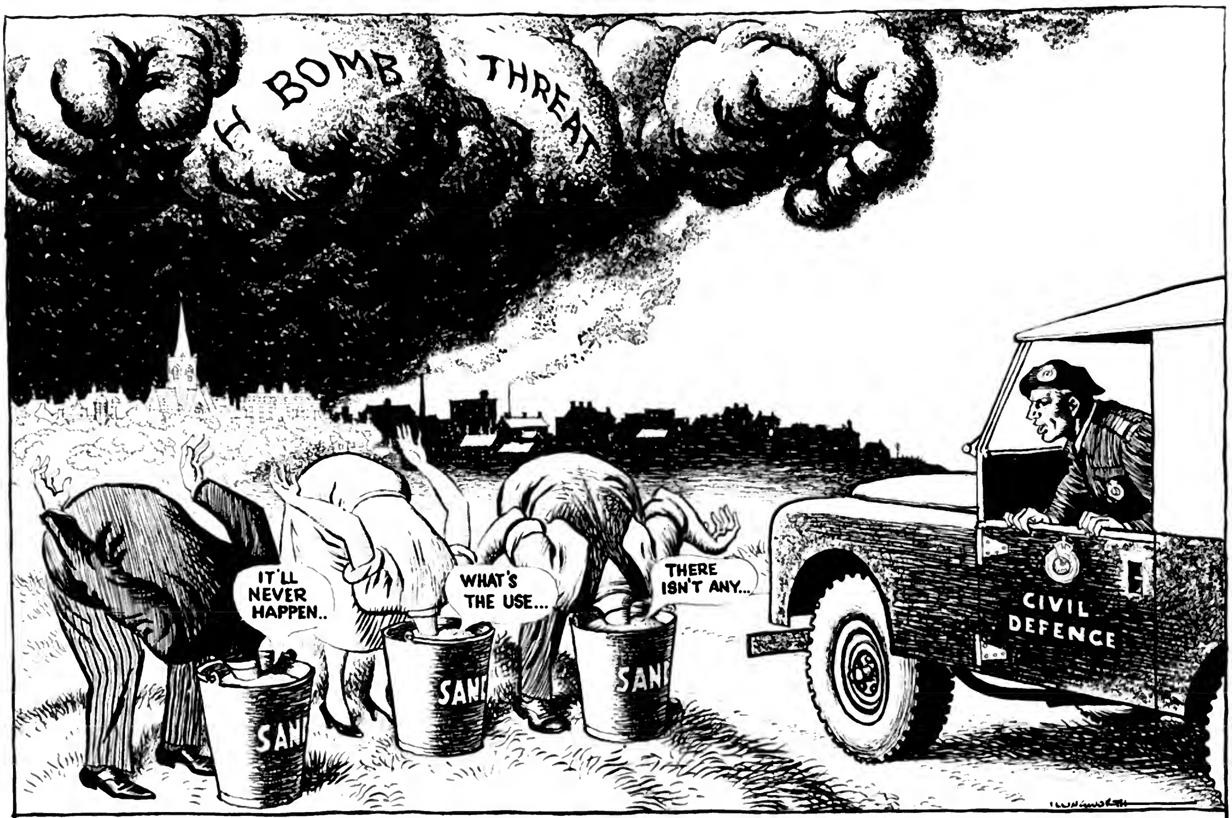
All these fly bombs fell in the summer months of 1944 which were unusually dry. In winter in this country in residential areas there are many open fires which may provide extra sources of ignition. The domestic occupancy is a low fire risk however, and as the proportion of such property in the important City and West End areas is small this should not introduce any serious error. Moreover, in winter, the high atmospheric humidity and the correspondingly high moisture content of timber would tend to retard or even prevent the growth of fire.

In order to determine how many fly bombs are equivalent to one nominal atomic bomb one method is to compare the areas over which a given category of house damage is produced by each. If we do this for a $\frac{3}{8}$th mile air burst as at Hiroshima, the result is that 1 atomic bomb does as much damage as about 1,200 fly bombs.

This in itself is not a serious fire situation and it is doubtful whether it could ever give rise to a fire storm. In Hamburg 2,500 fires were started per square mile by a bomb density (combined H.E. and I.B.) of 2oo tons per square mile, and for the area of destruction produced by an atomic bomb this would correspond to a total of about 10,000 fires.

Takata, A.N., Mathematical Modeling of Fire Detenses, IITRI, March 1970, AD 705 388.





IF YOU THINK IT'S HOPELESS, YOU'RE WRONG

Specially drawn for H.M. Government by Illingworth

Cartoon by Leslie Illingworth

FOUR STRAIGHTFORWARD SIMPLE FACTS ABOUT

Civil Defence Today

The basic minimum of information for every responsible man and woman

1 The H-Bomb: we hear too much of the horrors, not enough about our chances of survival. Some people will tell you that if this country were attacked with H-Bombs, every man jack of the population would be wiped out. ***That just isn't true: it isn't anything LIKE the truth.***

There would be terrible devastation, but for millions and millions of people, chances of survival would be very good. It depends very much on our Civil Defence. The more people we have in it, the better.

2 Civil Defence is well on with the job already. Some people think of Civil Defence equipment as a long-handled shovel, a rather odd tin hat, and so on.

Well, it's not like that at all. Civil Defence today is a modern, country-wide Service, which offers you training with first-class equipment—radio and radiation-testing instruments, fire-fighting apparatus and rescue gear, and the latest four-wheel-drive vehicles. There are thousands of qualified Instructors, three full-time Instructors' Schools, and a Staff College for advanced courses and studies.

The more you get to know about Civil Defence, the more impressed you become.

There is a Civil Defence organisation in every town in the Kingdom, and there are units in thousands of industrial firms. There are *half a million* people in the Civil Defence Services today. But half a million is not enough: not nearly.

3 Civil Defence is useful to you now, in peace. In Civil Defence today, you *learn*. That is the whole aim and object of joining.

You learn, first and foremost, how to live with your eyes open in the same world as the H-Bomb. You begin to learn what this new, nuclear-age world is really like. You acquire a fuller, deeper understanding of many important events that we are all involved in, whether we like it or not.

Besides this, there is a practical, everyday value in the things you learn. Take just one part of it—First Aid. In Great Britain in 1956 there were over *a quarter of a million* casualties from motor accidents, and probably at least another *million* casualties from accidents in the home. What you know—or don't know—about First Aid could make all the difference to somebody.

Do you know how to put out a fire? Do you know how to operate a radio transmitter? These are two more of the useful, interesting things that Civil Defence could teach you, now.

Do you remember the East Coast floods, the Lynmouth disaster, the Harrow rail smash? These are three of the emergencies where trained volunteers from Civil Defence were ready and able to help. They were needed.

4 Civil Defence wants more volunteers, NOW. It's no good saying "I'll be there on the day." That's too late. There wouldn't be time to train you and organise you.

It's no good leaving Civil Defence to other people. For everybody else, *The Other Fellow is YOU.*

You live in this world, you are part of the nuclear-age—there is no opting-out for anybody. Civil Defence *matters*—and matters to YOU.

Go along to your Council Offices today, and ask about Civil Defence. There's no commitment, no 'bull', no length-of-service engagements.

Your training takes only about *one hour a week*. The classes are free, and are near your own home. The knowledge you gain could be useful to you at any time, and would be VITAL to you if we were at War.

Civil Defence is sound common sense. It's high time you were in it.

Warden Section

Headquarters Section

Ambulance and Casualty Collecting Section

Welfare Section

The FOURTH Arm

Traditionally, we have three Services in this country: the Royal Navy, the Army, and the Royal Air Force. Now, we have a fourth service of the Crown—unarmed, volunteer, part-time—but not less vital than the others: Civil Defence. We have peacetime Civil Defence for just the same reasons that we have a peacetime Navy, Army and Air Force: it is an essential part of our ordinary peacetime national preparedness. *That is all there is to it.*

WHAT YOU CAN DO IN CIVIL DEFENCE

Five Sections: *which will you join?*

WARDEN. This is a job for a man or woman with a quick, cool head and the power of leadership—and something of a flair for getting on with people. The Warden takes control of the area in an emergency and directs the other services where they are required.

HEADQUARTERS. This is the nerve-centre, where the reports come in and the orders go out. If you are an office or scientific worker, a radio 'ham', motor-cyclist or driver—here is interesting, important work that you could train for now.

RESCUE. Members of Rescue Squads are highly skilled. Each man carries a pack containing saw, wrecking-bar, lashings, wire-cutters and First Aid kit—and he is trained in the use of all of them. Backing up the Rescue Squad is a special Rescue Vehicle, with scaffold-poles, cables, winches, stretchers and heavy rescue gear. A rescue man needs intelligence as well as strength.

The **AMBULANCE AND CASUALTY COLLECTING** Section want two sorts of people—casualty collectors, to give First Aid and see that the injured get back safely to the ambulances—and drivers to take the ambulances back to hospital. This is work for both men and women—and if you drive a car already, so much the better.

The **WELFARE** Section would be called on first to help in bringing care and comfort to some millions of evacuees. But that is only the beginning of their job. After an attack, there would be more millions of people, to be housed, clothed, fed and kept healthy. Our very survival could depend on what the Welfare Section did then. The Welfare Section needs dependable, intelligent, capable men and women; and it needs them now.

AND THE AUXILIARY FIRE SERVICE, which also has really worth-while, practical training to offer. The work is important; a nuclear explosion sends out an intense heat-wave, and fires would be numerous and quick to spread. The A.F.S. has special nuclear-war fire-fighting apparatus: you would do your training with it.

IN EVERY SECTION YOU GET FIRST AID TRAINING

Rescue Section

Auxiliary Fire Service

Civil Defence Recruiting Drives are going on now, all over the country. Their object is to tell you all about Civil Defence — what it can do, what it IS doing and what there is in it for you.

CIVIL DEFENCE is common sense

Go to your Council Offices and ask, today. They will be glad to see you.

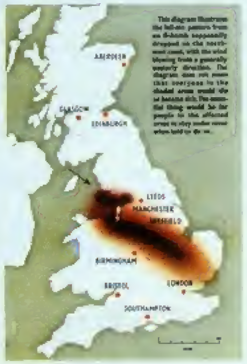
ISSUED FOR H.M. GOVERNMENT BY THE CENTRAL OFFICE OF INFORMATION

UK National Archives: INF 2/122

September 1957 national press advert

THE Hydrogen Bomb

WHAT THE HYDROGEN BOMB DOES



The hydrogen bomb's power is reckoned in millions of tons of high explosive; its searing fireball, white and blinding, is as hot as the sun's interior. It can gouge a crater in the earth a mile wide and up to 200 feet deep; and its dust can cause death or sickness hundreds of miles away if proper precautions are not taken. The menace is threefold, for the hydrogen bomb strikes with heat, blast and deadly radiation.

HEAT from the fireball, a mile-and-a-half across, instantly vaporizes anything it touches before it soars into the upper skies. Fiercest during the first ten seconds, its rays can burn exposed skin or set fire to houses as far away as 10 to 15 miles. They can still be felt at 50 miles.

BLAST surges outwards at the speed of sound, accompanied by a hurricane wind. It enters doors and windows, causing buildings to "explode". It tilts or overthrows walls in its path. An overhead burst crushes roofs through their supporting walls. The worst danger is that people might be struck by flying wreckage, or hurled to the ground or against walls or other objects. Light damage from an air burst could be found as far as 20 to 25 miles from the centre of the explosion, and windows would be broken even farther away.

RADIATION The rising fireball sucks up and contaminates debris and dust and this is carried downwind to drift slowly back to earth as "fall-out". There it continues to give out dangerous radiation. Radiation is particularly dangerous because it cannot be felt or smelled, tasted, heard or seen. It can be detected and measured only with sensitive instruments. Even if you kept all the fall-out dust off you, you might still be injured, if you stayed in the open, by radiation from fall-out many yards away.

The photograph shows Britain's nuclear test explosion at Christmas Island on 15 May, 1957. The whirling mushroom, now well developed, has pierced the local natural cloud.

What YOU could do

Simple precautions which you and your family could take against heat, blast and radiation could save your lives. Heat and blast are familiar from the last war. Radiation is new, and only a thick shield of metal, masonry, earth or other heavy matter will protect you against it. Used to the best advantage, an ordinary house with 9-inch brick walls should reduce the danger from radiation to one-twentieth. Here are some things you could do if war looked likely:

Site a refuge in basement or cellar, or in the ground floor room with the fewest outside walls. Thicken the walls with sandbags or even heavy furniture. Block the windows. Equip the refuge with essentials, including chairs and couches, books and a battery-run radio. Store an ample supply of food and water.

Alternatively, dig an outside trench, cover it with a strong roof, put two or three feet of earth on top. Equip it like an indoor shelter if possible. A trench may be less comfortable than an indoor shelter but there is no risk from collapsing upper floors and walls. Whether in trench or indoors, obey radio instructions. Because of fallout you might have to remain two or more days under cover.

It is the contents of a house which catch fire, and not the bricks and mortar. So keep out as much of the heat flash as possible.

Remove curtains, furnishings and anything inflammable from windows and doorways.

Whitewash the window panes. This will block many of the heat, which will be largely over before the blast splinters up to shatter the glass.

WHAT YOU CAN DO NOW Join the Civil Defence Corps or the Auxiliary Fire Service. They will teach you how to help yourself and others if war should come.

APPLY TO YOUR LOCAL COUNCIL OFFICES

What CIVIL DEFENCE can do!

There is no absolute safeguard against an H-bomb attack. Nothing could stop widespread casualties and devastation. But life would go on. It would be disrupted and distorted, with many familiar services lacking or severely cut, but that would not mean an end to everything – not by any means. Millions of people would survive to carry on. How many, and how far they succeeded, would largely depend on their knowledge of what to do as a nation and as individuals before and after the bombs struck.

Civil Defence, the part-time, volunteer Fourth Arm of our defence services, is being trained to act in an H-bomb emergency. Established throughout Britain, its members would spring to action in the stricken areas. Civil Defence is organised and trained to allay panic, aid the injured, trapped and homeless, and help to establish order and maintain the nation's life.

The Civil Defence Corps and its allied services each have specialised jobs as well as general duties.

THE HEADQUARTERS SECTION

Controls operations, provides scientific intelligence, establishes "fall-out" danger zones, arranges communications.

THE WARDEN SECTION

Provides the men, cool-headed and resourceful, who are the link between civil defence and the public and direct the other services where they are most needed.

THE RESCUE SECTION

Using specialist equipment, frees people trapped under wreckage or in shattered buildings. Duties may range from demolition work to providing first aid.

THE WELFARE SECTION

Houses, feeds and cares for the homeless and hungry.

THE AMBULANCE & CASUALTY COLLECTING SECTION

gives first aid, gets the casualties to the ambulances, and takes them to hospital.

The Fire, Police, Nursing and other allied Services, with their normal duties doubled by an emergency, link with the Civil Defence Corps in carrying out the plan for survival.

PREPARED FOR THE HOME OFFICE BY THE CENTRAL OFFICE OF INFORMATION

PRINTED FOR H.M. STATIONERY OFFICE BY J. HEWITT & SON LTD., NOTTINGHAM

HOME OFFICE

CIVIL DEFENCE

Manual of Basic Training

VOLUME II

ATOMIC WARFARE

PAMPHLET No. 6

(Based on survival in Hiroshima and Nagasaki after 20 kt bursts)

LONDON: HIS MAJESTY'S STATIONERY OFFICE
1950

TWO SHILLINGS NET

FOREWORD BY THE PRIME MINISTER

The object of this pamphlet is to provide all members of the Civil Defence Corps and other Services associated with Civil Defence with a short manual of practical information about the atomic bomb and its effects. It is, of course, our earnest hope that we shall never have to experience the horrors of an atomic attack. The tremendous force of atomic power should be used for industrial and humanitarian purposes and not for mass destruction. Ever since the Washington Declaration, which I signed with the President of the United States and the Prime Minister of Canada in November 1945, the United Kingdom has pressed for international agreement to ensure that atomic energy should be used only for peaceful purposes. But any such agreement would be illusory without the most rigorous system of international control. Although nearly two years ago nine out of the eleven members of the United Nations Atomic Energy Commission agreed on what they considered to be a really effective plan for the control of atomic energy and although this plan was subsequently approved by the overwhelming majority of the General Assembly of the United Nations, the Soviet Union has so far refused to accept it, and has instead put forward counter-proposals which were rejected in the Commission by a nine to two vote on the ground that they did not provide an adequate basis for effective international control. We shall not, however, abandon our hope that an effective system of international control may ultimately be adopted by the United Nations, and we for our part will certainly do all in our power to make such an agreement possible. In the meantime we must proceed with our Civil Defence preparations on the basis that, in the event of war, we might be subjected to atomic attack and with the object of minimising the casualties which must inevitably accompany such an attack.

June, 1950.

C R Attlee

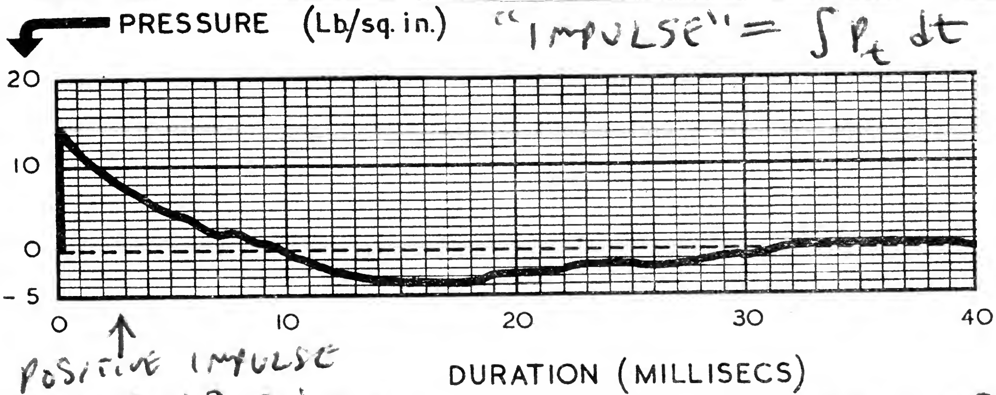
CONTENTS

NOTE

The pagination of this pamphlet is not continuous as it may be necessary to introduce new pages at a later date.

Photo No. 18. NAGASAKI. Typical small earth-covered back yard shelter with crude wooden frame, less than 100 yds. from the centre of damage, which is to the right. There was a large number of such shelters, but whereas nearly all those as close as this one had their roofs forced in, only half were damaged at 300 yds., and practically none at half a mile from the centre of damage.

Debunking impulse blast criteria:



POSITIVE IMPULSE = 0·12 psi-sec

FIG. 2. — PAGE 13.

Figure 2 shows a typical pressure-time curve from a medium sized high explosive bomb at a distance at which fairly severe structural damage would be caused. **- page 11**

If the impulse criterion were applied to the atomic bomb it would be expected to demolish 9-inch brick walls to a distance of over 10 miles. However, at this distance from the atomic bomb the peak pressure is only about 0.1 lb./sq. in. which is very much less than the static strength of the wall, and consequently, however long this pressure is applied, it cannot hurt the wall. It will thus be seen that the impulse criterion breaks down for the atomic bomb. The position is that the blast impulse is only the criterion of damage so long as the maximum blast pressure is substantially greater than the static strength of the target, and this is not the case at the limits of damage to normal structures with an atomic bomb. With the atomic bomb, therefore, blast pressure rather than impulse tends to be the criterion of damage. If the effective blast pressure exceeds the static strength of the structure failure must be expected, whereas if it is less no failure can occur however long the duration of the blast. **- page 12** **(debunks American propaganda!**

Photo No. 7. HIROSHIMA. Reinforced concrete building about 300 yds. from the centre of damage, which is to the left of the photograph. There was no serious structural damage, although a roof panel was depressed and some internal party walls were deflected. Designed for earthquake resistance, this building has a composite reinforced concrete and steel frame.

SIMPLE WALL SURVIVING CLOSE TO GROUND ZERO.

Photos Nos. 1 and 2. HIROSHIMA. General views looking across the centre of damage, the approximate position of which is marked with an arrow. It will be seen that some of the framed buildings quite near the centre remained standing. The tall building in Photo No. 1 is the same as that seen in Photo No. 7. The foreground illustrates the remnants of Japanese dwellings, razed to the ground. =THE OBSOLETE WOODEN HOUSES BURNED DOWN.

Protection against blast would not present an insoluble problem. Japanese air raid shelters, even of poor construction, stood up well and underground shelters were a complete protection. Shelters could be constructed to resist both blast and gamma rays.

28. **Effects on Material** PAGE 39:

From air burst bombs the blast wave is from above downwards and strikes roofs first, and near the centre of the damaged area buildings are collapsed or, with specially strong buildings, roofs are crushed in or dished even where the walls remain standing. Further away, where the blast wave is becoming more horizontal, buildings are pushed over or distorted.

The type of building and the distance from ground zero are the factors influencing reaction to blast. Unframed buildings like ordinary dwelling houses suffer more severe damage than framed buildings, whether of reinforced concrete or steel, and buildings of earthquake-resisting construction remain practically undamaged at 2,000 feet from ground zero. Bridges, which are built to withstand vertical pressure, stand up to the blast much better than ordinary houses, which are not so constructed, though reflection from roads, rivers, etc., may cause displacement on the underside and is a point to be carefully watched.

The British Mission estimated that from a high air burst bomb such as was used in Japan, an ordinary British city with 15 houses and 45 persons to the acre would suffer damage to dwelling houses to a distance of 2 to 2½ miles from ground zero on the following scale:—

Nature of Damage	*Average Radius from Ground Zero and Number of Houses Involved*
Demolished or requiring demolition	1 mile 30,000 houses
Uninhabitable and requiring major repairs	1–1½ miles 35,000 houses

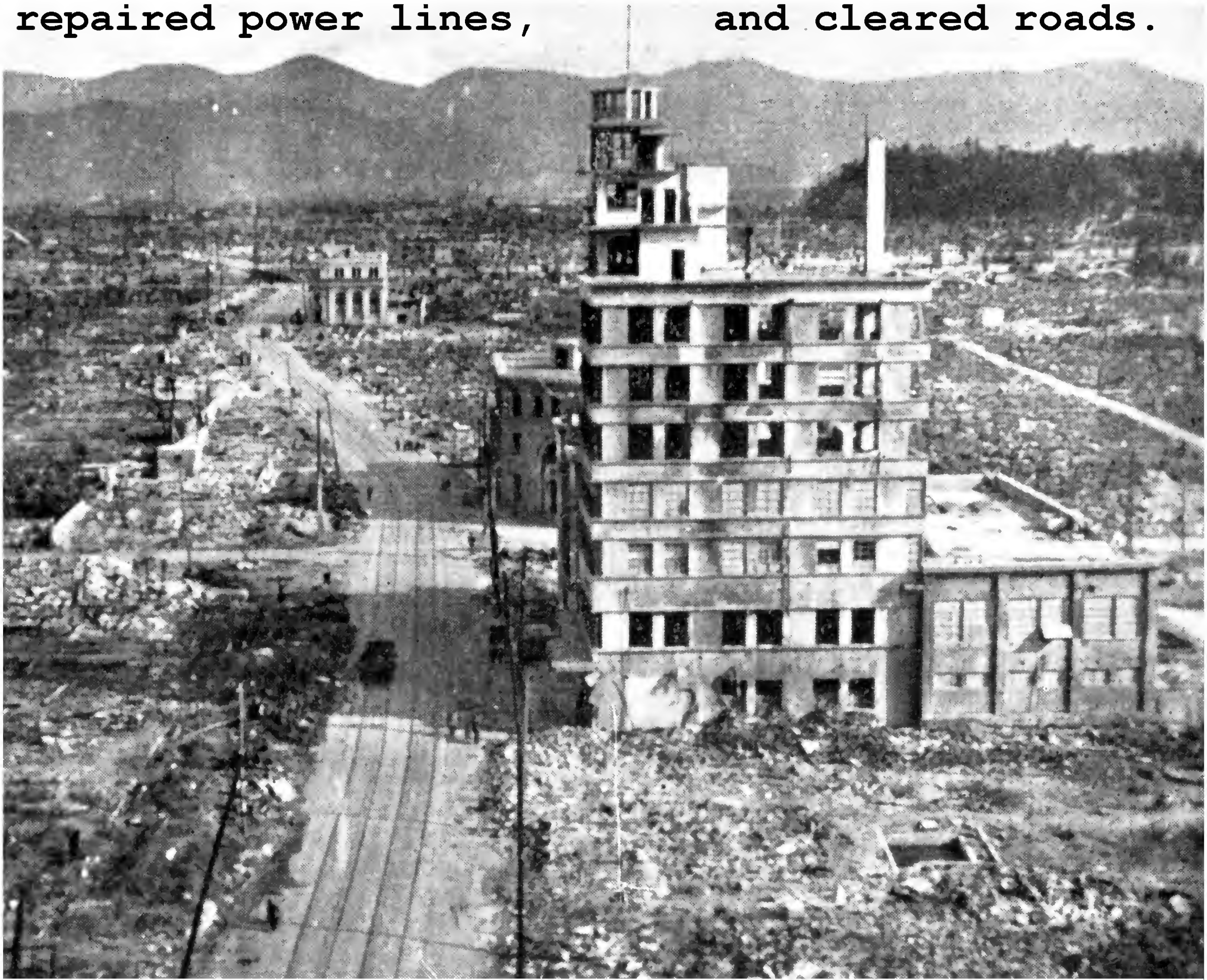
5. **Estimates of Casualties in a British City** — PAGE 13:

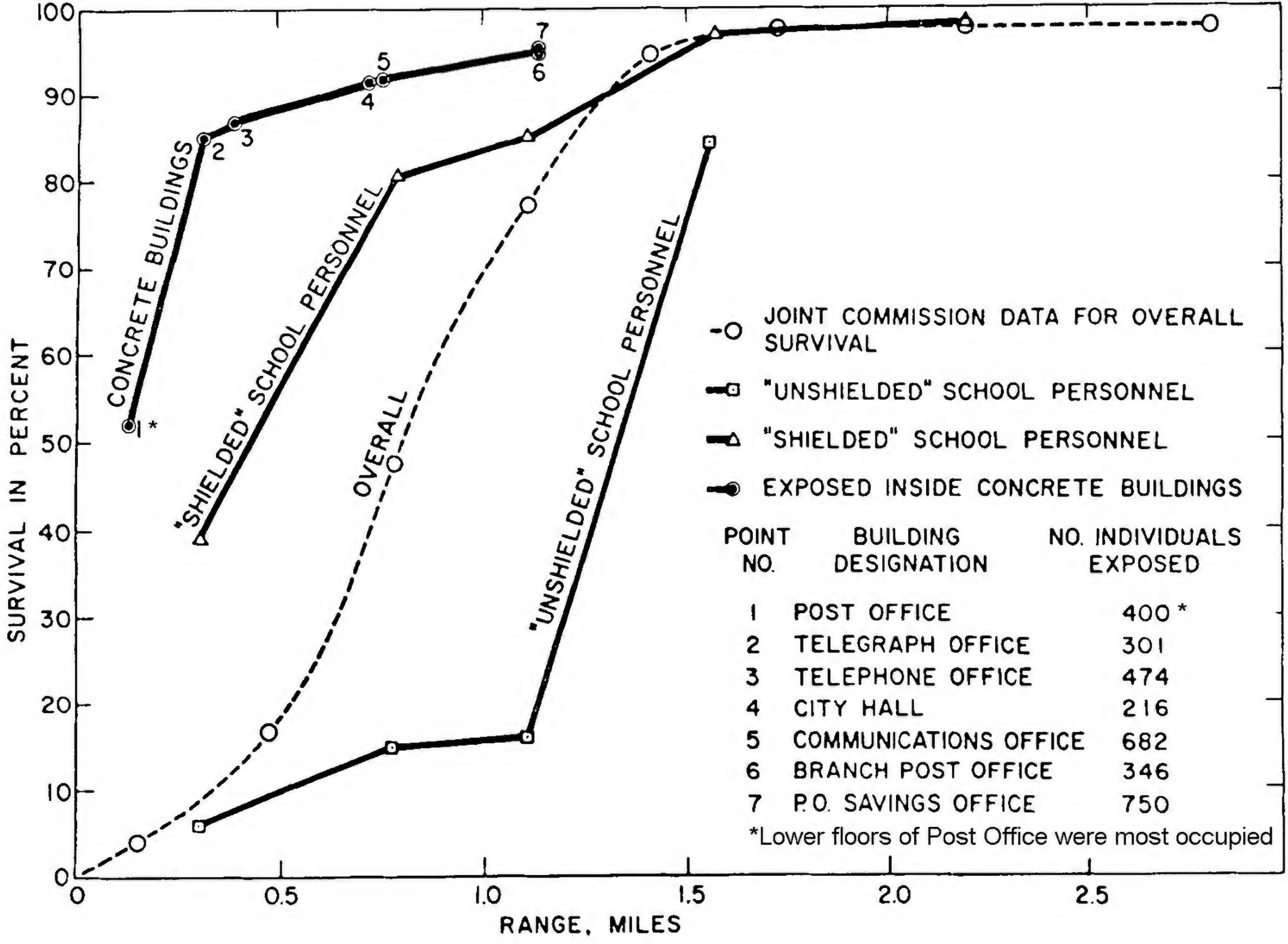
If the people in our cities were caught, as were the Japanese, without warning, before any evacuation had taken place, and with no suitable shelters, the casualties caused by a high air burst bomb would be formidable. The British Mission to Japan estimated that *under these circumstances* as many as 50,000 people might lose their lives in a typical British city with a population density of 45 persons to the acre. Much can be done, however, to mitigate the effects of the bomb and to save life, and it is certain that with adequate advance preparations, including the provision of suitable shelters and with good Civil Defence services, the lives lost could be reduced to a fraction of the number estimated by the British Mission.

The figures set out in the preceding paragraph are those given as an estimate by the British Mission from the experience of the high air burst bombs used in Japan and under similar conditions would apply to persons in a British city. *It must be stressed however that they apply to persons caught in the open with no warning or suitable shelter,* and that even ordinary houses will give some degree of protection by lessening the intensity of the rays that penetrate them. — PAGE 9.

Hiroshima at
2 days after burst

Hiroshima in November 1945: note boarded windows
repaired power lines, and cleared roads.





Percentage of survivors as a function of range from Ground Zero (Hiroshima). (Ref. Joint Commission Report, Vol. VI, Document NP-3041.)

SURVIVAL IN WOODEN AND CONCRETE BUILDINGS, HIROSHIMA

TABLE 7.3

Casualties among the Groups Exposed to the Atomic Bomb inside Wooden Houses, Hiroshima

Name of Building	Structure	Distance and Direction from Hypocenter (km)	Number Exposed	Mortality Rate (%)
Lodging for an itinerant theatrical troupe	Two-story	0.7 E	17	100.0
Second Hiroshima Army Hospital	Single-story	1.0 N	402	75.3

Source: Science Council of Japan, *Genshibakudan Saigai Chōsa Hōkokusho* [SRIABC] (Tokyo: Nihon Gakujutsu Shinkōkai, 1951), p. 25.

TABLE 7.4

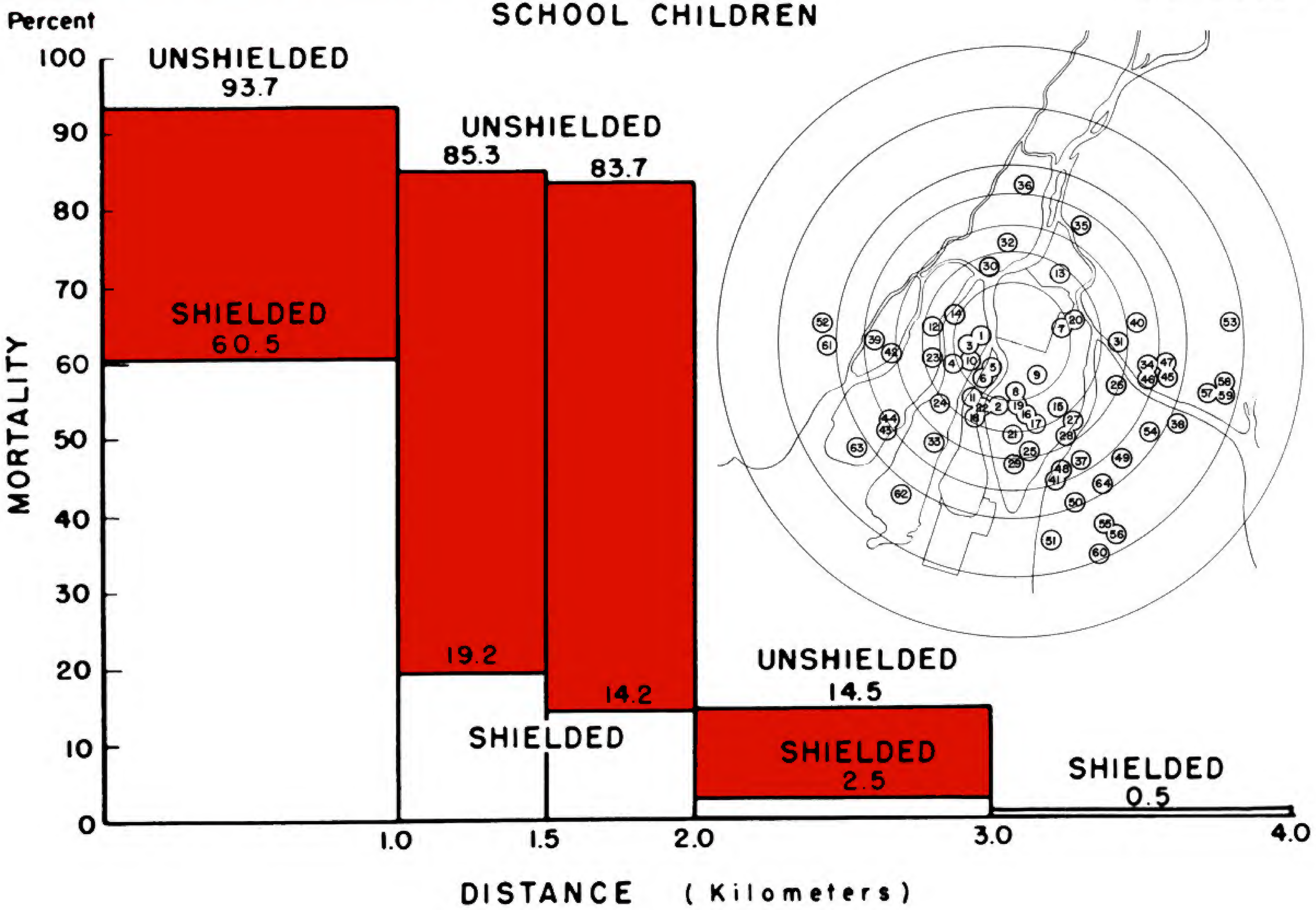
Casualties among the Groups Exposed to the Atomic Bomb inside Concrete Buildings, Hiroshima

Name of Building	Structure	Direction and Distance from Hypocenter (km)	Number Exposed	Mortality Rate (%)
The Bank of Japan, Hiroshima Branch	three-story	0.4 SE	75	57.3
Broadcasting Station	two-story	1.0 E	31	6.5
Communication Bureau	four-story	1.4 N	245	6.1
Japan Red Cross Hospital, Hiroshima	three-story	2.0 S	480	0.4

• While the total number of exposed is known, it has not been possible to determine how many died instantly or soon after the explosion.
Source: Science Council of Japan, *Genshibakudan Saigai Chōsa Hōkokusho* [SRIABC] (Tokyo: Nihon Gakujutsu Shinkōkai, 1951), p. 26.

Above: extract from "Hiroshima and Nagasaki: The Physical, Social and Medical Effects", 1981

THERMAL FLASH SHIELDING HIROSHIMA
SCHOOL CHILDREN



In Hiroshima, only 0.9% (17 burns) of 1,881 burns were due to ignited clothing, and only 0.7% (15 burns) were due to burns by firestorm flames!

TABLE 8.3A

Number of Persons with Burns from Different Causes (Tokyo Imperial University's First Survey, October–November 1945)

Distance from Hypocenter (km)	Secondary Burns† From Clothes on Fire	Secondary Burns† By Flame	Total Burns
0.6–1.0	3 (3.3)		89
1.1–1.5		1 (1.1)	327
1.6–2.0	4 (0.5)	4 (1.2)	717
2.1–2.5		6 (0.8)	558
2.6–3.0	5 (0.8)	3 (0.5)	140
3.1–3.5	4 (2.8)	1 (0.7)	41
3.6–4.0	1 (2.4)		4
Total	17 (0.9)	15 (0.7)	1,881

* Primary burns are burns by thermal rays from the A-bomb.
† Secondary burns are burns by fire other than thermal rays.
‡ Figures in parentheses are percentages of incidence.
Source: T. Kajitani and S. Hatano, "Medical survey on acute effects of atomic bomb in Hiroshima," in CRIABC vol. I, p. 522.

Note: there were 5 burns cases within 0.6 km, all primary

TABLE 8.3B

Region of Burns

	Head		Face		Neck		Total	
	Outdoors	Indoors	Outdoors	Indoors	Outdoors	Indoors	Outdoors	Indoors
Number of persons	179 (11.7)*	44 (12.3)	1,030 (67.4)	127 (35.7)	643 (42.1)	78 (21.9)	1,526	355
Total	223 (11.8)		1,157 (61.5)		721 (38.3)		1,881	

* Figures in parentheses are percentages of incidence.
Source: T. Kajitani and S. Hatano, "Medical survey on acute effects of atomic bomb in Hiroshima," in CRIABC vol. I, p. 522.

Above: extract from "Hiroshima and Nagasaki: The Physical, Social and Medical Effects", 1981 by the Japanese Committee for the Compilation of Materials on Damage Caused by Atomic Bombs

HIROSHIMA: Bankers Club, 250 m from GZ, view looking out from GZ.
Photograph date: 27 November 1945.

HIROSHIMA: Nippon Bank, 450 m from GZ, view from GZ. Photograph date: 27 November 1945.

HIROSHIMA: Telephone Exchange Building, 550 m from GZ, view from GZ
Photograph date: 27 November 1945

HIROSHIMA: Radio Broadcasting Studio, 900 m from GZ, view from GZ
Photograph date: 27 November 1945.

HIROSHIMA: City Hall, 1200 m from GZ, view from direction of GZ.
Photograph date: 27 November 1945.

HIROSHIMA: Red Cross Hospital, 1600 m (1 mile) from GZ,
view looking from the direction of GZ
Photograph date: 27 November 1945

HIROSHIMA: 26 October 1945

HIROSHIMA: 27 November 1945

SINGLE NON-NUCLEAR INCENDIARY AIR RAID: TOKYO, 10 MARCH 1945

AIR MINISTRY
AP 3349

RESTRICTED
The information given in this document is not to be communicated, either directly or indirectly, to the Press or to any person not authorized to receive it.

WO
CODE No.
9466

26/GS Trg Publications/2329

PRECAUTIONS AGAINST NUCLEAR ATTACK

1957

(Superseding Precautions Against Atomic Attack, 1952 (WO Code No. 8769))

Promulgated by Command of the Army Council,

E. W. Playfair

Promulgated by Command of the Air Council,

J. H. Barnes

Telegraph pole burnt on the side facing the flash. Note where foliage has acted as a shield

Shelter 100 yards from the centre of damage—Nagasaki

Protection against fall-out

101. Except in the immediate vicinity of a nuclear explosion a reasonably accurate prediction of the area of fall-out can be made in time for a warning to be issued to units in the areas in which it is likely to fall. Given a reasonable warning it may be possible to evacuate the area before the fall-out arrives. In any case simple precautionary measures can greatly reduce the hazard to life.

102. Exposure to the radio-active radiations from fall-out can be reduced by taking shelter and by using simple decontamination procedures until such time as persons can leave the area. In areas where radio-active contamination is heavy it may be necessary to remain under cover for as long as 48 hours before the radiations will have fallen, by natural decay, to levels at which it will be safe for persons to move about, either to leave the area, or, in the case of rescue teams from other areas, to enter it.

103. The estimated degree of protection against the residual radiation to be obtained from buildings, trenches, etc, in a fall-out area is shown at Table 7:—

TABLE 7. **Estimated degree of protection against the residual radiation to be obtained from various buildings, trenches, etc, in a fall-out area**

Type of building or shelter	INSIDE dose expressed as a fraction of the OUTSIDE dose	
Slit trench with light board or corrugated iron overhead	$\frac{1}{2}$	
Slit trench with 1 ft of earth overhead	$\frac{1}{100}$	
Slit trench with 2 ft to 3 ft of earth overhead	$\frac{1}{200}$ to $\frac{1}{300}$	
Nissen hut	$\frac{1}{2}$	
One storey brick house	$\frac{1}{10}$ to $\frac{1}{20}$	dependent upon wall thickness and shielding afforded by neighbouring houses
Two storey brick house	$\frac{1}{10}$ to $\frac{1}{50}$	
Three storey brick house	$\frac{1}{15}$ to $\frac{1}{100}$	
Average two storey house in a built up area	$\frac{1}{40}$	
Basements	$\frac{1}{200}$ to $\frac{1}{300}$	dependent upon shielding afforded by neighbouring houses

COPY No. 15
14 PAGES

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AWRE – T1/53

[redacted]

Wde 22/10/84 . SCO 468 refers

NATIONAL ARCHIVES
ES5/1

MINISTRY OF SUPPLY

ATOMIC WEAPONS RESEARCH ESTABLISHMENT

REPORT No. T 1/53
(HURRICANE)

B.0134

A.W.R.E.
Aldermaston Berks.

[redacted]

May, 1953

3.2 Blast Damage

Outdoor peak overpressure was 51 psi at 500 yds, 25 psi at 665 yds and 10 psi at 1,000 yds 3 psi extended to 2,000 yds

3.2.1 Anderson Shelters

Standard Anderson Shelters, with sandbag covering and blast wall construction were locat.d at 460, 510, 600, 920 and 1,130 yards from ground zero. Mean blast pressures, in pounds/sq. inch, recorded inside the shelters are shown in the following table.

Distance (yds.)	Presentation		
	Front	Side	Rear
460	NR	NR	NR
510	38	27	40
600	28	21	28
920	16	7	14
1130	8.5	4	5.5

Front presentation implies blast wall facing towards event.
Rear " " " " " away from event.
Side " " shelter side on to event.

Shelters at 460, 510 and 600 yards suffered damage including demolition of blast walls, removal of sandbag covering and some displacement of the corrugated iron.

At 920 and 1,130 yards the shelters suffered relatively little damage.

Civil defence authorities consider that there might have been some 50% survival from blast damage of personnel in shelters at 460 yards and some 90 per cent at 600 yards, fatal casualties being mainly due to secondary blast effects (e.g. debris) and not to direct effects on the person of the blast pressure itself. The front presentation appears the most hazardous, due to the collapse of the blast wall into the shelter. At such distances, however, the survival from the effects of gamma flash would have been virtually nil. (MORE EARTH COVER IS NEEDED FOR RADIATION.)

At 920 and 1,130 yards there would have been no casualties from blast, and incidentally, little risk from the effect of gamma flash.

UK NATIONAL ARCHIVES: ES 5/2

ANDERSON SHELTER TESTS AGAINST 25 KT NUCLEAR NEAR SURFACE BURST (2.7 METRES DEPTH IN SHIP)

AWRE-T1/54, 27 Aug. 1954

SECRET—GUARD

ATOMIC WEAPONS RESEARCH ESTABLISHMENT

(formerly of Ministry of Supply)

SCIENTIFIC DATA OBTAINED AT OPERATION HURRICANE

(Monte Bello Islands, Australia—October, 1952)

$$p = \frac{130 \times 10^9}{R^3} + \frac{7 \cdot 7 \times 10^6}{R^2} + \frac{13 \cdot 5 \times 10^3}{R}$$

p is the maximum excess pressure in p.s.i. and R is the distance in feet

Fig. 12.1, Andersons at 1380 ft range from bomb ship shown in the photo, moored 400 yards off shore.

Left: Fig. 12.3, Andersons at 1800 ft after burst. Right: Fig. 12.4, Andersons protected by blast walls at 2760 ft.

12.1. *Blast Damage to Anderson Shelters*

At 1,380 feet, Fig. 12.1, parts of the main structure of the shelters facing towards and sideways to the explosion were blown in but the main structure of the one facing away from the explosion was intact, and would have given full protection. At 1,530 feet, Fig. 12.2, the front sheets of the shelter facing the explosion were blown into the shelter but otherwise the main structures were more or less undamaged, as were those at 1,800 feet, Fig. 12.3.

At 2,760 feet, Fig. 12.4, some of the sandbags covering the shelters were displaced and the blast walls were distorted whilst at 3,390 feet, Fig. 12.5, the effect was quite small. At these distances, the shelters were not in direct view of the explosion owing to intervening sandhills.

13. The Penetration of the Gamma Flash

13.1. *Experiments on the Protection from the Gamma Flash afforded by Slit Trenches*

13.1.1. The experiments described in this section show that slit trenches provide a considerable measure of protection from the gamma flash. From the point of view of Service and Civil Defence authorities this is one of the most important results of the trial.

13.1.2. Rectangular slit trenches 6 ft. by 2 ft. in plan and 6 ft. deep were placed at 733, 943 and 1,300 yards from the bomb and circular fox holes 2 ft. in radius and 6 ft. deep were placed at 943 and 1,300 yards.

The doses received from the flash were measured with film badges and quartz-fibre dosimeters in order to determine the variation of protection with distance, with depth and with orientation of the trench and the relative protection afforded by open and covered trenches.

In general, the slit trenches were placed broadside-on to the target vessel but at 1,300 yards one trench was placed end-on. Two trenches, one at 733 and one at 943 yards were covered with the equivalent of 11 inches of sand.

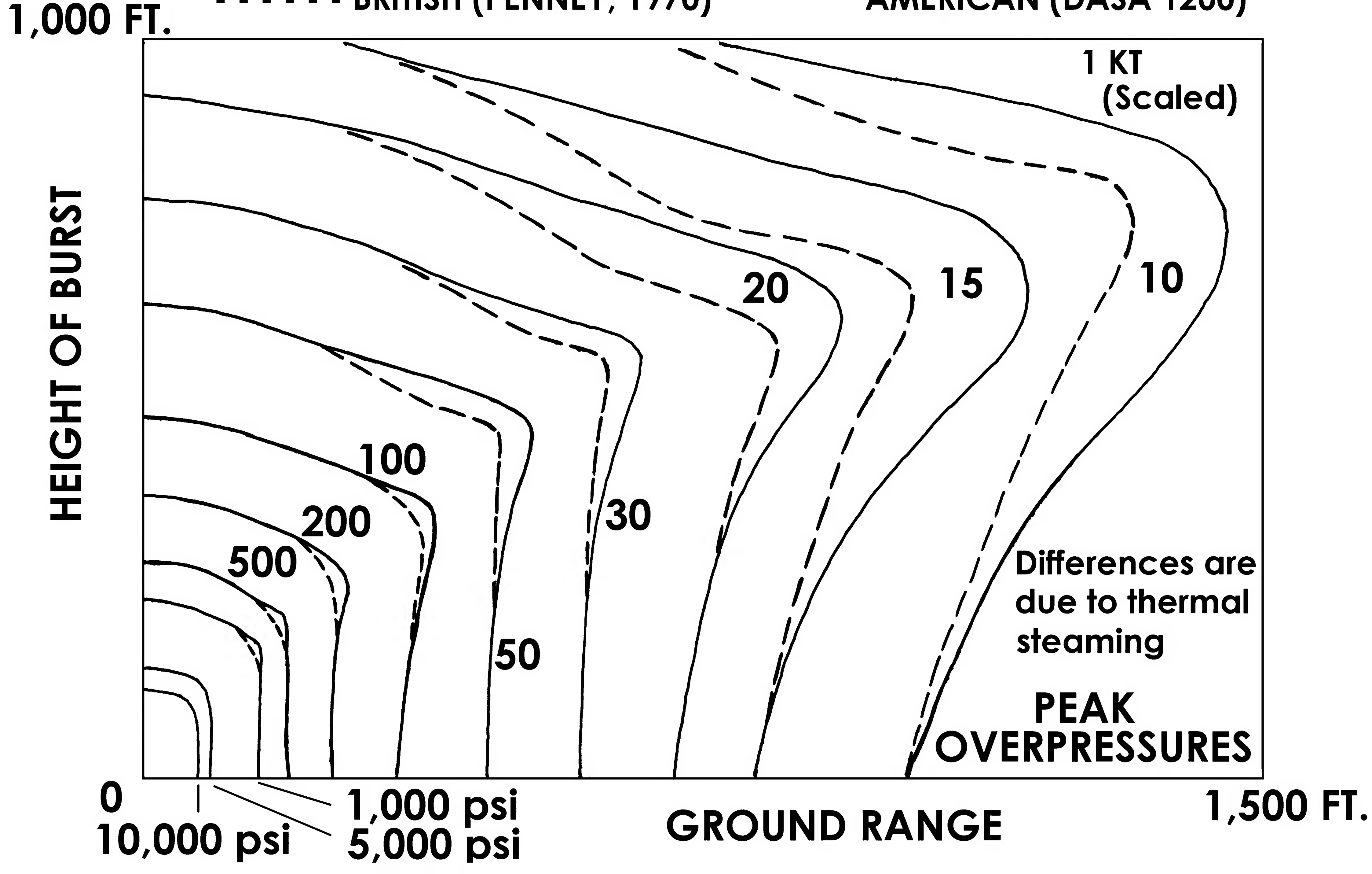
Table 13.1

Variation of Gamma Flash Dose on Vertical Axis of Trench

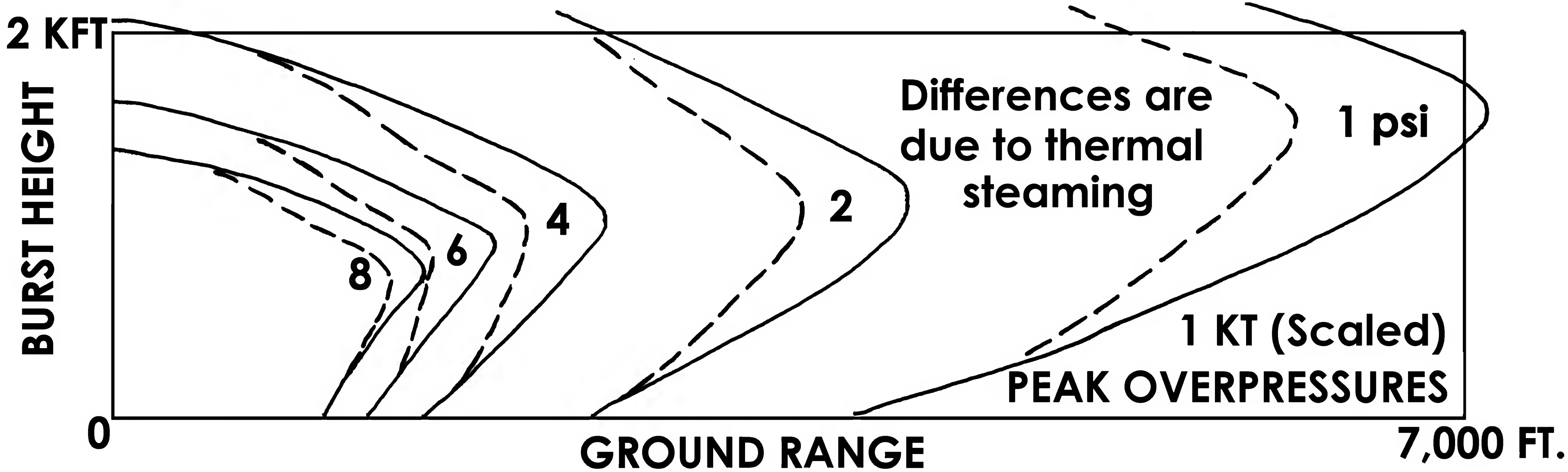
Type of trench	Rectangular broadside-on open			Rectangular end-on open	Circular open		Rectangular broadside-on covered	
Distance (yards) ...	1,300	943	733	1,300	1,300	943	943	733
Surface dose (Roentgens)	300	3,000	14,000	300	300	3,000	3,000	14,000
Depth below ground level (inches)								
6 ...	150	1,000	—	230	214	1,200	(75)	—
12 ...	75	430	—	150	120	545	47·6	—
24 ...	33·3	150	584	60	54·5	188	25	(140)
36 ...	23	70	216	31·6	30	86	13	(56)
48 ...	(20)	43	100	20	17·7	48·5	7·7	(31)
60 ...	—	(37·5)	61	13·6	10·7	(33·3)	5	(23)
72 ...	—	—	(46·7)	(8·6)	7	—	(3·5)	—

Entries in brackets are extrapolations or estimates.

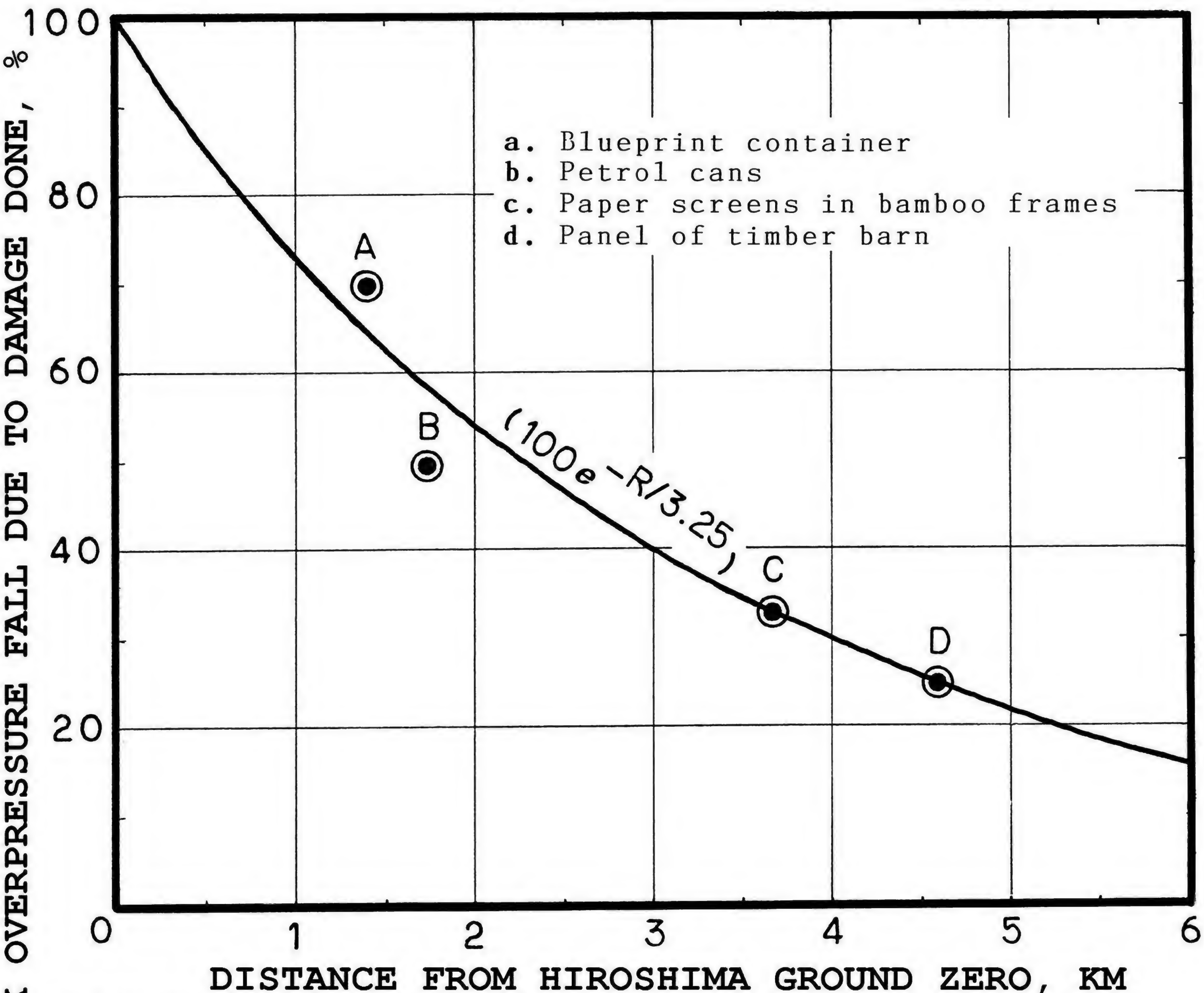
COMPARISON OF BRITISH NUCLEAR HEIGHT OF BURST CURVES WITH AMERICAN
(British data avoid thermal steaming of ground, thus apply to modern cities)



COMPARISON OF BRITISH NUCLEAR HEIGHT OF BURST CURVES WITH AMERICAN
(British data avoid thermal steaming of ground, thus apply to modern cities)
- - - - - - BRITISH (PENNEY, 1970) ——— AMERICAN (DASA 1200)



Lord Penney (1970) explains that the thermal energy deposited on desert surface before the blast arrives adds energy to the near-surface blast (hot air steams upward rapidly by convection; this is for 1-15 kt low yield air bursts that do NOT popcorn the desert sand, so there is NO precursor dust storm, just heated air). Where ground range >> burst height, in a modern city the first high rise building absorbs the majority of the thermal flash energy, preventing this effect. (Penney proves that modern buildings in Hiroshima and Nagasaki actually ABSORBED blast energy, causing a further attenuation factor, not included above.)



Data from Dr W. G. Penney, et al., 'The Nuclear Explosive Yields at Hiroshima and Nagasaki', Phil. Trans. Roy. Soc., v266 (1970), pp. 357-424.

HOME OFFICE
SCOTTISH HOME DEPARTMENT

MANUAL OF CIVIL DEFENCE

Volume I

PAMPHLET No. 2

RADIOACTIVE FALL-OUT

PROVISIONAL SCHEME OF PUBLIC CONTROL

LONDON
HER MAJESTY'S STATIONERY OFFICE
1956

Radioactive Fall-out—Summary of Provisional Control Zones

Zone	Definition of Zone Boundaries	Range of Cumulative Doses in open at 48 hours	Summary of permissible and recommended action	Range of Cumulative Doses assuming observance of control rules
W	Outer: Limit of area placed under "Black Warning" (*see* Footnote). Inner: 0·3 r.p.h. at 48 hrs.	Up to 80r	Complete release from refuge as soon as dose-rate fell to 0·3 r.p.h. or, if the rate had not reached that figure, when fall-out was complete.	At 48 hrs. Below 2r
X	Outer: 0·3 r.p.h. at 48 hrs. Inner: 3 r.p.h. at 48 hrs.	80–800r	Qualified release from refuge after 48 hrs.—indoor workers to follow normal occupations, but not to exceed 4 hrs. per day in the open. Outdoor workers to work half shifts for next five days. At the end of this period the zone would be normal, except that all would be advised to be out of doors as little as possible and not in any case to exceed 8 hrs. per day in the open for the next three months.	At 48 hrs. 2-20r At 7 days 6-60r At 5 wks. 12-120r At 3 mths. 14-145r
Y	Outer: 3 r.p.h. at 48 hrs. Inner: 10 r.p.h. at 48 hrs.	800-2,800r	Release from refuge under stringent control after 48 hrs. For the next 12 days people should not leave their refuge for longer than necessary. Time in the open should not exceed 2 hrs. per day and time under cover, but not in refuge, a further 8 hrs. On this basis essential indoor workers should be able to get to their places of work, but outdoor work would remain suspended; a relaxation would be possible after the first fortnight and further easement in another three weeks. For the rest of the first year, however, people in this zone should not exceed 8 hrs. a day in the open.	At 48 hrs. 20-70r At 14 days 50-170r At 5 wks. 70-240r At 3 mths. 95-330r
Z	10 r.p.h. at 48 hrs.	Above 2,800r	All movement outside refuge accommodation in this zone would be dangerous. People should remain in refuge until instructions for clearance were given—they should then leave the zone by the quickest available route if they had means of transport or wait in their refuge to be collected if they had not. The clearance operation might start after 48 hrs. and removal from the zone would be for at least 3 months.	At 48 hrs.—Above 70r

The initial Zone W boundary would be defined by the boundaries of a series of warning districts on the flanks of the fall-out. After 48 hrs. Zone W would for public control purposes have disappeared: its outer boundary would have moved during the period to coincide with the outer boundary of Zone X.

The question of defining an area extending in some places beyond Zone W in which there might be an agricultural hazard is being studied.

TECHNICAL ANALYSIS REPORT - AFSWP NO. 507

RADIOACTIVE FALL-OUT HAZARDS FROM SURFACE BURSTS OF VERY HIGH YIELD NUCLEAR WEAPONS

by

D. C. Borg
L. D. Gates
T. A. Gibson, Jr.
R. W. Paine, Jr.

MAY 1954

HEADQUARTERS, ARMED FORCES SPECIAL WEAPONS PROJECT
WASHINGTON 13, D. C.

e. Passive defense measures, intelligently applied, can drastically reduce the lethally hazardous areas. A course of action involving the seeking of optimum shelter, followed by evacuation of the contaminated area after a week or ten days, appears to offer the best chance of survival. At the distant downwind areas, as much as 5 to 10 hours after detonation time may be available to take shelter before fall-out commences.

f. Universal use of a simply constructed deep underground shelter, a subway tunnel, or the sub-basement of a large building could eliminate the lethal hazard due to external radiation from fall-out completely, if followed by evacuation from the area when ambient radiation intensities have decayed to levels which will permit this to be done safely.

Table II

Total Isodose Contour: 500r from Fall-out to H+50 Hours

Yield (MT)	15	1	10	60
Downwind extent (mi)	180	52	152	340
Area (mi^2)	5400	470	3880	17,900

HOME OFFICE
SCOTTISH HOME DEPARTMENT

General Information

(All Sections)

CIVIL DEFENCE
POCKET BOOK NO. 3

LONDON
HER MAJESTY'S STATIONERY OFFICE
1960

Zone	*Dose-rate at H+48 hours*	*Summary of permissible and recommended action*
W	Less than 0.3 r.p.h.	Remain in refuge until released, which can be as soon as dose-rate falls to 0.3 r.p.h. or when fall-out is complete if the rate has not reached that figure.
X	0.3—3 r.p.h.	Remain in refuge until H+48 hours; then qualified release. Indoor workers to follow normal occupations, but not to exceed 4 hours per day in the open for the next 5 days. Outdoor workers would have to do half shifts to keep within this figure. At the end of a week the zone would be normal, except that all would be advised to be out of doors as little as possible, and not in any case to exceed 8 hours per day in the open for the next 3 months.
Y	3—10 r.p.h.	Remain in refuge until at least H+48 hours; then release under stringent control. For the next 12 days time in the oper should not exceed 2 hours per day. On this basis essential indoor workers should be able to get to their work, but outdoor work would remain suspended. After the first fortnight it would be possible to increase the essential time spent out of doors to 4 hours per day for the next three weeks, increasing this to 8 hours per day thereafter for the rest of the first year.
Z	10 r.p.h. or more	Remain in refuge until told to leave. All movement outside refuge in this zone would be dangerous. People should remain until instructions for clearance are given; they should then leave by the nominated route if they have means of transport—or wait in their refuge to be collected if they have not. The clearance operation might start after H+48 hours and removal from the Zone would be for at least 3 months.

HOME OFFICE

SCOTTISH HOME DEPARTMENT

MANUAL OF CIVIL DEFENCE

Volume I

PAMPHLET No. 1

NUCLEAR WEAPONS

LONDON

HER MAJESTY'S STATIONERY OFFICE

1956

Practical protection

88 Large buildings with a number of storeys, especially if they are of heavy construction, provide much better protection than small single-storey structures (see Figure 4). Houses in terraces likewise provide much better protection than isolated houses because of the shielding effect of neighbouring houses.

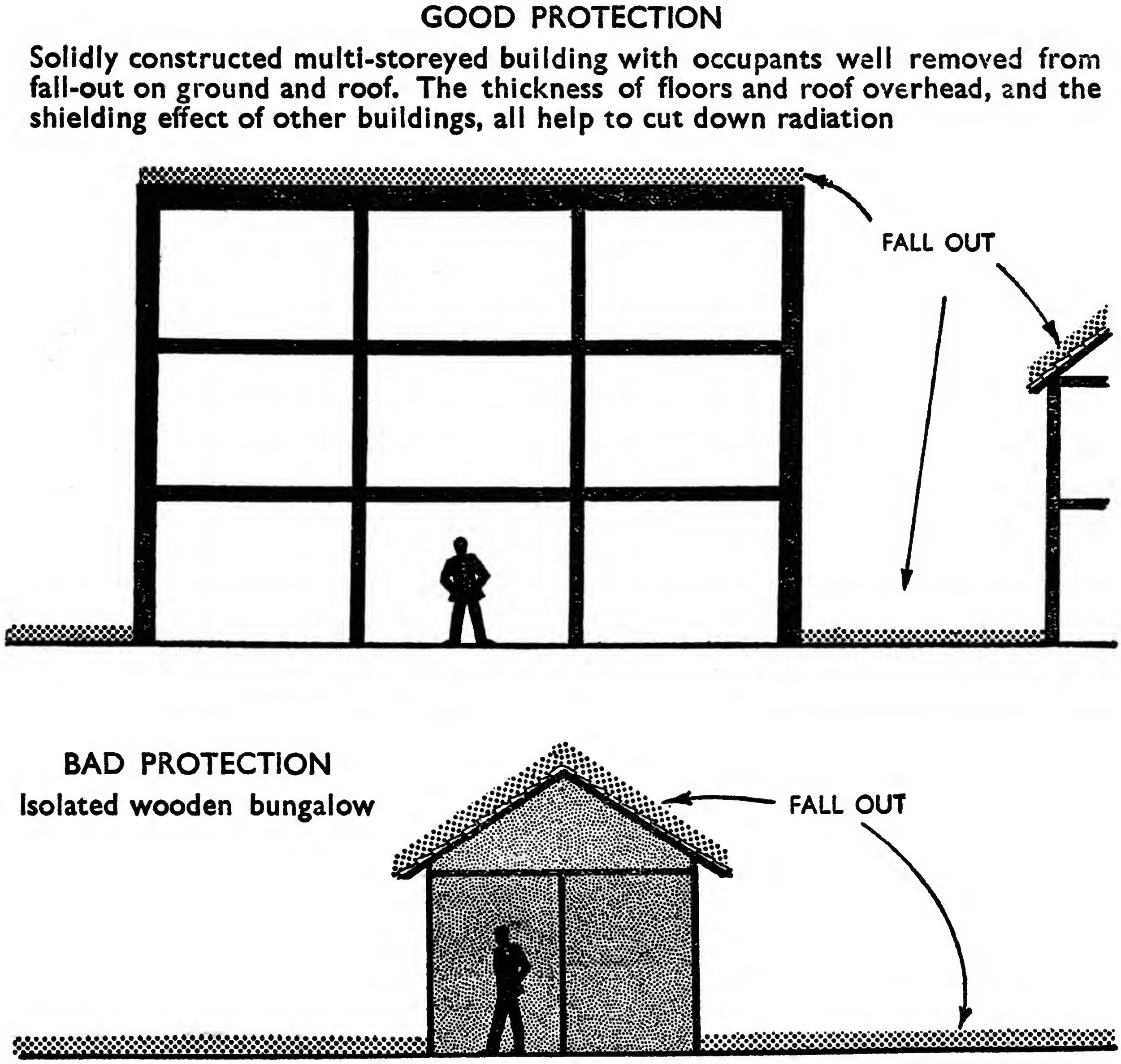


FIGURE 4

Examples of good and bad protection afforded by buildings against fall-out.

89 It is estimated that the protection factor (the factor by which the outside dose has to be divided to get the inside dose) of a ground floor room in a two-storey house ranges from 10 to about 50, depending on wall thickness and the shielding afforded by neighbouring buildings. The corresponding figures for bungalows are about 10–20, and for three-storey houses about 15–100. An average two-storey brick house in a built-up area gives a factor of 40, but basements, where the radiation from outside the house is attenuated by a very great thickness of earth, have protection factors ranging up to 200–300. A slit trench with even a light cover of boards or corrugated iron without earth overhead gives a factor of 7, and if 1 ft. of earth cover is added the

factor rises to 100. If the trench can be covered with 2 or 3 feet of earth then a factor of more than 200–300 can be obtained (see Figure 5).

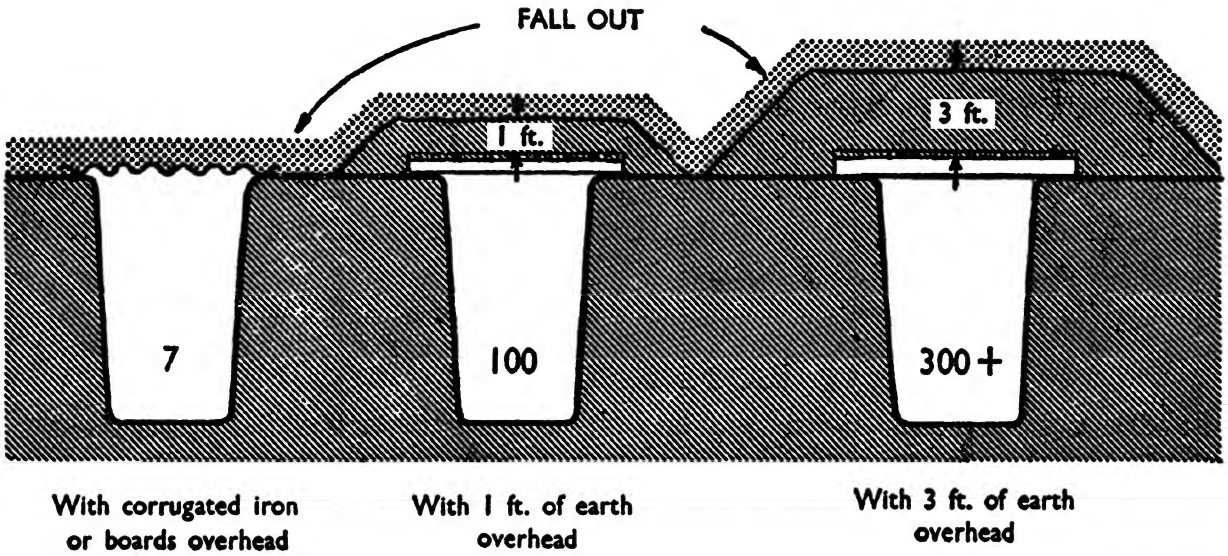


FIGURE 5
Protection factors in slit trenches (the factor by which the outside dose is divided to get the inside dose).

Choosing a refuge room

90 In choosing a refuge room in a house one would select a room with a minimum of outside walls and make every effort to improve the protection of such outside walls as there were. In particular the windows would have to be blocked up, e.g. with sandbags. Where possible, boxes of earth could be placed round an outside wall to provide additional protection, and heavy furniture (pianos, bookcases etc.) along the inside of the wall would also help. A cellar would be ideal. Where the ground floor of the house consists of boards and timber joists carried on sleeper walls it may be possible to combine the high protection of the slit trench with some of the comforts of the refuge room by constructing a trench under the floor.
Once a trap door had been cut in the floor boards and joists and the trench had been dug, there would be no further interference with the peace-time use of the room.

Estimated under-cover doses in the fall-out area

91 Taking an average protective factor of 40 for a two-storey house in a built-up area, the doses accumulated in 36 hours for the ranges referred to in the U.S. Atomic Energy Commission Report (paragraph 84) would have been:—

190	miles downwind		7½r
160	,,	,,	12½r
140	,,	,,	20r

15 Megatons
Bravo 1954

which are all well below the lowest figure of 25r referred to in Table 1. At closer ranges along the axis of the fall-out, the doses accumulated in 36 hours would have been much higher, but over most of the contaminated area—with this standard of protection—the majority of those affected would have been saved from death, and even from sickness, by taking cover continuously for the first 36 hours.

5. Radiation sickness

Assume dose incurred in a single shift (3–4 hours) by the "average" man, over the whole body:—

25 roentgens	—No obvious harm.
100 ,,	—Some nausea and vomiting.
500 ,,	—Lethal to about 50 per cent. people (death up to 6 weeks later).
800 ,, or more	—Lethal to all (death up to 6 weeks later).

Note: If dose spread uniformly over 2–3 days, then 60 roentgens could be incurred with no more effect than 25 roentgens in a single exposure of 3–4 hours.

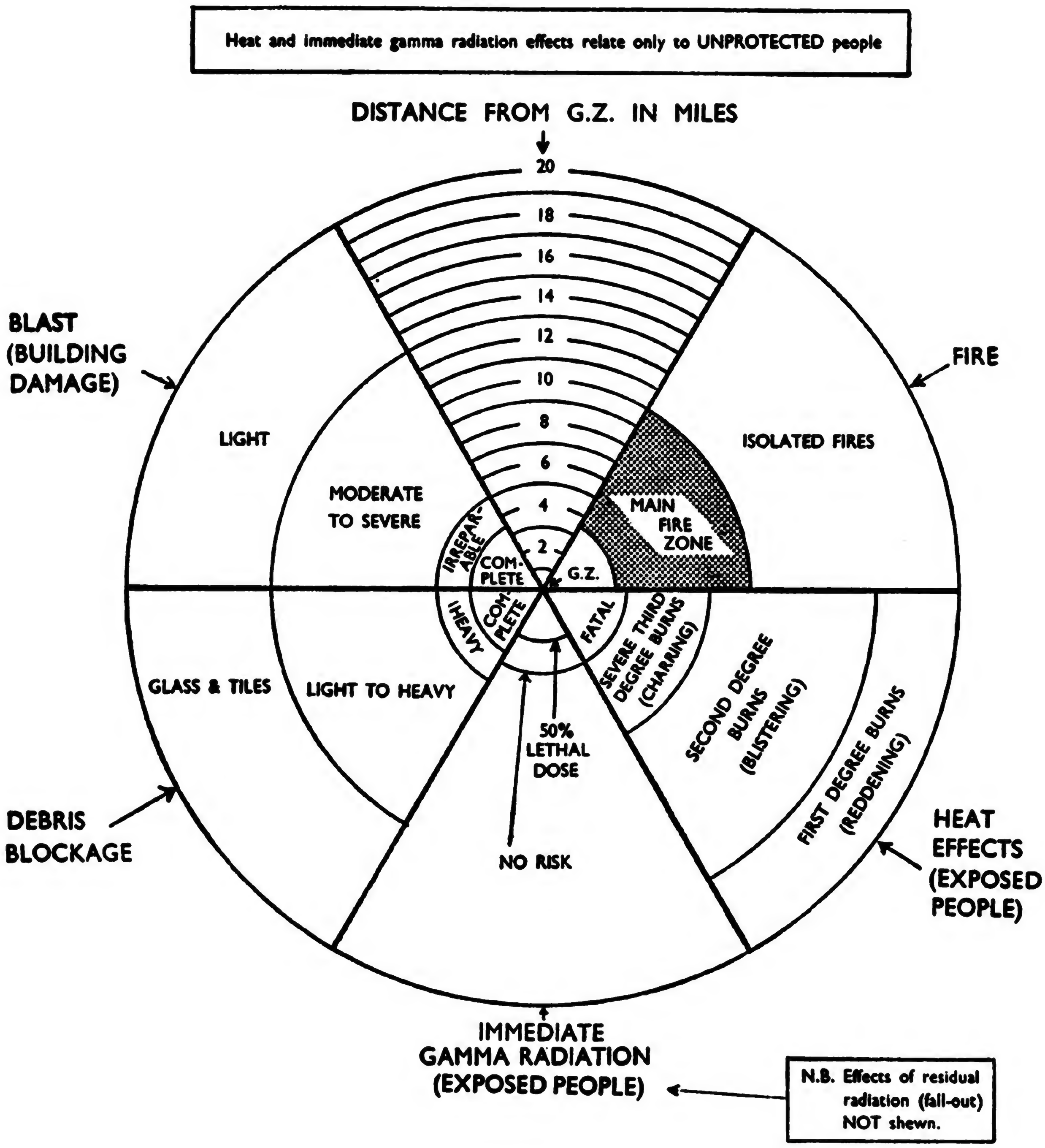


FIGURE 11

Combined effects (excluding residual radioactivity) from a 10 megaton ground burst bomb. Heat and immediate gamma radiation effects relate only to UNPROTECTED people.

HOME OFFICE

CIVIL DEFENCE
TRAINING MEMORANDUM No. 3

The Control of Civil Defence Operations under Fall-out Conditions

(England and Wales)

LONDON
HER MAJESTY'S STATIONERY OFFICE
1959

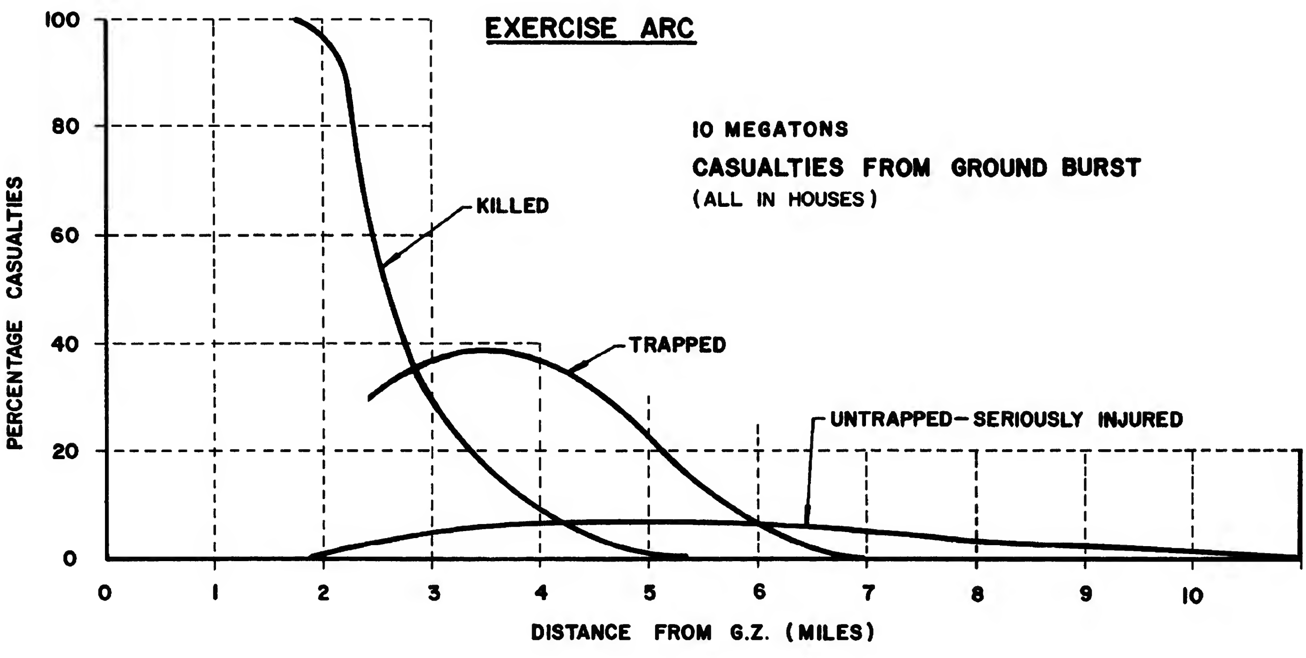
SIXPENCE NET

Civil Defence Training Memorandum No. 3, "The Control of Civil Defence Operations under Fall-out Conditions," U.K. Home Office, 1959

Paragraphs 6-14 explain that the need for rapid life-saving rescue and evacuation from the damaged areas near ground is to be balanced by the fallout gamma dose rate hazard to the civil defence workers; for optimum results first aid and rescue workers should move inwards (toward ground zero) at about the same speed the 10 R/hour gamma outdoor dose rate contour moves inward due to the natural radioactive decay of fallout (because fallout radiation decays rapidly, the dose rate at 48 hours being only about 1% of that at 1 hour):

"The balance of advantage would differ according to the nature of the work; but for the rescue and casualty services it is thought that the best results would be obtained from working at or about a dose rate of 10 R/hour, so that the wartime emergency dose [75 R] was used up in a single shift of about 8 hours. … Some forces, e.g. ambulances, could operate profitably where their dose was spread out over longer periods than 8 hours by working at lower dose rates than 10 R/hour. Others, e.g. reconnaissance parties with special responsibility for rapid penetration, might have to take their wartime emergency dose without heed to the 10 R/hour [fallout map pattern/contour] line and reduce their working period accordingly. … units would continue with their task … with reference only to the total dose accumulated on their dosimeters. … The radiological limit should be taken as the 1,000 R/hour at H + 1 contour which will be 10 R/hour line at H + 48 [due to the 100 fold decay of fallout radiation between 1 and 48 hours after a nuclear explosion] and so mark the limit to which life-saving forces can be expected to have penetrated by that time. …

"The task will be set by the number of casualties trapped, or seriously injured but untrapped … capable of being succoured within the first 48 hours. As soon as possible after ground zero, weight and nature of attack are known, the Controller should have casualty estimates made … This will be done by applying the population figures for the Sectors casualty percentages as shown on the graph (from Exercise ARC) attached as an appendix to this memorandum, which sets out, on the best evidence at present available [blast casualties from applying Blitz casualty data as a function of house damage to nuclear test data showing the amount of house damage versus distance from a nuclear explosion, which automatically takes account of the duration of the blast wave in nuclear explosions], the proportions of seriously injured, trapped and untrapped, to be expected at different distances from ground zeroes of bombs of varying power. … A single Forward Medical Aid Unit can be expected to deal with about 120 seriously injured an hour – say 1,000 in each shift – and to continue working throughout the operational period with only internal reliefs. … At the beginning of operations a 4-berthed ambulance can be expected to take about 1 hour on the round trip from ambulance loading point … A single casualty collecting party can handle and send to ambulance loading points about 12 seriously injured an hour, or, say, 100 per shift [8 hours]. … A single [light] rescue party [using slow manual methods used in 1941, without any of the tracked cranes and rescue dogs used to rapidly clear debris off casualties in 1944-1945, during the V1 and V2 attacks on London] can release two or three trapped persons an hour or, say, 20 per shift."



USNRDL-TR-1049
28 July 1966

AD 641480

REMOVAL OF SIMULATED FALLOUT FROM ASPHALT STREETS BY FIREHOSING TECHNIQUES

by

L.L.Wiltshire
W.L.Owen

In general, removal effectiveness improves with increased particle size range and increased mass loading. For the expenditure of an effort of 4 nozzle-minutes (12 man-minutes) per 10^3 ft^2, results ranged as follows:

Particle Size Range (μ)	Nominal Mass Loading (g/ft^2)	Removal Effectiveness (Residual Fraction)
44 - 88	4.0	0.16
	24.0	0.07
350 - 700	4.0	0.005
	24.0	0.003

U.S. NAVAL RADIOLOGICAL DEFENSE LABORATORY

SAN FRANCISCO · CALIFORNIA 94135

FALLOUT DECONTAMINATION, RETENTION AND UPTAKE

'A number of factors make large-scale decontamination useful in urban areas. Much of the area between buildings is paved and, thus, readily cleaned using motorized flushers and sweepers, which are usually available. If, in addition, the roofs are decontaminated by high-pressure hosing, it may be possible to make entire buildings habitable fairly soon, even if the fallout has been very heavy.' – Dr Frederick P. Cowan and Charles B. Meinhold, *Decontamination,* Chapter 10, pp. 225-40 of Dr Eugene P. Wigner (editor), *Survival and the Bomb,* Indiana University Press, Bloomington, 1969.

Measured Efficiency of Decontamination by Firehosing Dry Fallout Deposits*

1-hour dose rate:	300 R/hr	1,000 R/hr	3,000 R/hr
Fallout deposit:	100 g/m^2	330 g/m^2	1,000 g/m^2
Portland cement concrete	96%	98%	99.2%
Tar and gravel roof	97%	98%	99%
Galvanised steel	95%	98%	99.4%
Smooth painted surface	96%	99%	99.6%

**Radiological Recovery of Fixed Military Installations,* U.S. Army Chemical Corps technical manual TM-3-225, 1958. Firehosing uses 4 cm diameter hoses, each crewed by 2-4 people, and utilising 100 gallons/minute of water; each hose decontaminates 700 m^2/hour. The water pressure needed is 5 atmospheres. The fallout is flushed into underground drain sewers with the water.

According to fallout decontamination studies on paved areas at distances of 600-1600 m from the 1951 *Sugar* nuclear surface burst and *Uncle* shallow underground burst: 'High-pressure water hosing was found to be the most rapid and effective procedure tested... None of the tested procedures [which included dry sweeping and vacuum cleaning] resulted in significant contamination of the operator's protective clothing.' (J.C. Maloney, *Decontamination of Paved Areas,* weapon test report WT-400, chapter 5, 1952.)

Priority firehosing of residential areas would be needed where the 1-hour dose rate is between 500-3,000 R/hr. At lower dose rates, there will be few casualties in any case (200 R being assumed to produce a 'casualty'), while at higher dose rates the hazard to decontamination crews is considered excessive, so protection would there depend on radiation shielding or evacuation. Decontamination could begin when the outdoor dose rate had decayed to 10 R/hr, i.e., 1-5 days after detonation for 1-hour dose rates of 500-3,000 R/hr. People in these zones must remain under cover indoors until decontamination is done. (An American study by Stanford Research Institute, *Systems Analysis of Radiological Defense,* in 1958 assumed that 1% of the population would be available to staff decontamination crews, and that each crew member is allowed a dose of 100 R.)

A study of decontamination was done by J.A. Miles of the British Home Office Scientific Adviser's Branch in 1965, *The Value of Area Decontamination in Reducing Casualties from Radioactive Fallout,* SA/PR-97, Secret. Miles found that firehosing roads, pavements, and houses to reduce dose rates by a factor of 4 requires 57,000 litres of water and 37 human-hours of effort per kilometre length of terraced streets; but twice this water and effort is needed for streets of semi-detached houses with front gardens. About 620 people live in each kilometre length of terraced streets, but only about 310 people live in each kilometre length of semi-detached housing. Terraced streets are thus the decontamination priority.

Several tested techniques are available to decontaminate different surfaces. Roads, paved areas, building surfaces, vehicles, aircraft and ships can be decontaminated by water hosing. Farmland requires a different technique. In fallout tests, single-pass deep-ploughing to a depth of 20-25 cm reduced the above-ground gamma radiation level from the fallout by 85%; using a 125 horse-power tractor with a 3-share plough, 3,250 m^2/hour was deep-ploughed. (*Radiological Recovery of Fixed Military Installations,* U.S. Army Chemical Corps technical manual TM-3-225, 1958.) Fallout is deep-ploughed to a depth below the root length of the crops, or alternatively the long-term agricultural uptake of strontium-90 and cesium-137 is simply diluted by adding chemically-similar calcium and potassium salts (respectively) to contaminated soil.

On smooth ground, it is possible to literally sweep away surrounding dry fallout with a broom, or to swill it down drains using an ordinary low pressure hose pipe. For concrete, 1 m height, and 0.7 MeV fallout gamma rays, the protection is:

Circular radius of decontaminated area (m)	Protection factor for the actual removal of fallout	Protection factor for just sweeping fallout to edge
5	1.4	1.3
10	1.8	1.5
15	2.0	1.8
30	2.7	2.3
60	4.1	3.5

There are three basic stages during radiological recovery from a nuclear war: (1) evacuation of old people with inadequate radiation shielding from heavy fallout areas if they are unable to improve their shielding sufficiently with sandbags, (2) sheltering in heavy fallout areas for a few days in the part of the house furthest from the roof and outside walls, with as much mass shielding of the inner refuge as possible while the intense danger falls sharply by natural radioactive decay, and (3) outdoor decontamination to avoid long-term exposure.

It is also possible to essentially avert the entire fallout problem by using the washdown system during fallout deposition. It is more effective to fix up a cheap water hose spray to clean the roof, walls, and surrounding urban paved areas while fallout is landing, than to spend money on sheltering, which will not remove a single fallout particle! Focus on expensive sheltering and measuring of radiation was a mistake made by Herman Kahn of the RAND Corporation in 1958, and has unfortunately overshadowed the more valuable discovery that if you do not waste time, you can just wash the fallout down the drain! (Kahn thought just in terms of an invisible radiation problem, not in terms of a physical fallout problem.) The continuous washdown system was tested on manned ships during the 1950s nuclear tests, having been developed after a study of the 1946 Bikini fallout problems. If you leave the fallout for weeks, decontamination becomes more difficult, because particles end up firmly lodged in crevices, and you also miss the benefit of reducing the intense early time hazard.

F.T. Underwood of the British Home Office Scientific Adviser's Branch, reported fallout adherence studies between 1961-5 (reports CD/SA-103 and CD/SA-125). Underwood glued sheets of 0.13 cm thick PVC plastic on to London house roofs. They were fully intact for 1 year and lost only 10% area coverage after another year during winter storms. PVC covered roofs retain few fallout particles, and are smooth enough that light rain or a small water spray will decontaminate them. For a 45-degree roof slope, 90% of the retained fallout on PVC is removed by just 1 litre/m^2 of water (i.e., 0.1 cm of rainfall).

Without PVC, much more water is needed to first fill up all the pits and crevices in the roof where fallout particles are lodged, before they can be carried away. Over 90% of fallout particles that exceeded 1 mm in diameter rolled or bounced quickly enough to overcome friction, and fell straight of roofs with a 45-degree slope. However, 95% of fallout particles smaller than 0.2 mm in diameter adhered to a 45-degree sloping ceramic tiled roof, because they slowly rolled into small pits and crevices where they lodged. R.T. Graveson reported in 1956 that the normal roof of a fallout-contaminated typical American house in the Nevada desert was decontaminated by 5 cm of natural rainfall, causing in a reduction of the gamma dose rate within the house by a factor of 15 (*Radiation Protection within a Standard Housing Structure,* Nevada Test Site report NYO-4714). Studies of skin decontamination by E. Neale and E. H. Letts's paper *Radiological Decontamination: Removal of Dry Fallout from Skin and Clothing,* British Chemical Defence Experimental Establishment, Porton Technical Paper PTP-R-16, 1958, showed that washing removed 100% of dry fallout particles of 100 microns or more in diameter, but only 97.5% of particles with a diameter of 20 microns. Denim overalls are decontaminated with 90% efficiency in 5 minutes by a washing machine (100 revolutions per minute with 1% detergent), for particle diameters exceeding 10 microns.

Research on Removing Radioactive Fallout From Farmland

By P. E. JAMES, *agricultural engineer, Physical Control Laboratory, Northeastern Region,* and R. G. MENZEL, *soil scientist, Water Quality Laboratory, Southern Region, Agricultural Research Service*

US Department of Agriculture, Agicultural Research Service, Technical Bulletin 1464 (1973)

TABLE 12.—*Experiment K: Percentage of radioactivity determined at various depths after deep plowing*

Sampling depth (inches)	Radioactivity of high-clay content Pullman soil	Radioactivity of sandy loam Elkton soil
	Percent	*Percent*
3	0.5	0.5
9	.3	.5
15	1.2	.7
21	1.7	4.2
27	6.2	29.2
33	27.4	62.6
39	61.4	2.0

A power-driven streetsweeper or scraper cutting 2 inches deep removes about 90 percent of the contaminant.

Decontamination should be accomplished before rainfall washes the radioactivity into low places where it is difficult to remove.

Decontamination can be accomplished by a scraper with a 12-foot blade at the rate of 100,000 square feet (2.3 acres) in 3.3 hours.

Application of a concrete or asphalt coating over the radioactivity is ineffective and only makes later pickup of radioactivity more difficult.

Burying radioactivity 3 feet deep with a large plow is costly and ineffective in reducing the uptake of radioactivity.

Planting through a contaminated surface which is then left untilled is an ineffective way to reduce the uptake of radioactivity.

The species of the crop is a highly significant factor in the uptake of radioactivity.

TABLE 13.—*Experiment L: Uptake of strontium-85 by mature crops grown with different tillage operations and a growth inhibitor*

Crop	Fraction of strontium-85 application taken up with different treatments		
	Rotary-tilled	Deep-plowed	Deep-plowed with Na_2CO_3
	Percent $\times 10^4$	*Percent* $\times 10^4$	*Percent* $\times 10^4$
Sugarbeet tops	640	300	39
Sugarbeet roots	910	780	76
Sudangrass fodder	780	450	52
Soybean straw	650	540	35
Soybean seed	67	56	6
Cabbage	1,130	560	154

each sample was recorded. Table 13 summarizes the uptake of strontium-85 by mature crops grown with different tillage operations and a growth inhibitor.

To investigate the effectiveness of a conventional-type streetsweeper in removing fallout from contaminated land, Experiment M was conducted during the fall (table 14). The following variables: Type of soil, sweeping procedures, type of broom material, and use of gutter broom were considered. Several practical factors make mechanical streetsweepers attractive. Sweepers leave the topsoil relatively undisturbed; they are maneuverable in corners and around objects, and are much less destructive than scrapers to hard surfaces such as roads.

The soil type and condition were important factors in decontaminating. It was easier to decontaminate sandy soil than silty loam during the initial passes. Four passes were required on silty loam soil to achieve 90-percent decontamination, whereas, only three were required on a sandy soil. The fields were decontaminated after a rain and, consequently, were wet. Other results might occur from sweeping dry fields.

Investigations of the sweeping procedures showed that after three passes, a point of diminishing return for the effort expended occurs. Nevertheless, 10 passes removed 99 percent of the contamination. The sweeper operated as effectively at high groundspeed as it did when going slower. Higher speeds are preferable since the operator receives less exposure.

A steel wire main broom was more effective than a plastic main

TABLE 14.—*Experiment M: Cumulative percentage of radioactivity reduced by repeated passes of a rotating-brush, mechanical street sweeper with different brooms* [1]

Broom material and sweeping procedure	Cumulative percent removed from Sassafrass sandy soil by indicated number of passes					Cumulative percent removed from Elkton silt-loam soil by indicated number of passes				
	1	2	3	4	10	1	2	3	4	10 [2]
Main brooms	*Duplicative*					*Duplicative*				
Steel:										
Normal pass first	74	86	91	92	------	80	89	75	92	------
Suction pass first	73	86	92	94	100	84	95	85	94	------
Steel and gutter broom:										
Normal pass first	73	84	92	96	99	78	90	95	94	------
Suction pass first	52	75	93	90	------	50	54	77	78	------
Plastic:										
Normal pass first						38	51	70	90	------

[1] Data for results with the motorized vacuum sweeper and the rotary brush sweeper were recorded, but were not put in tabular form.

[2] The final part of this experiment was not conducted.

THE ABSORPTION BY PLANTS OF BETA-EMITTING FISSION PRODUCTS FROM THE BRAVO SOIL

By

A. A. Selders, J. F. Cline and J. H. Rediske

Plant Nutrition and Microbiology Unit
Biology Section
Radiological Sciences Department

December 20, 1955

HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

Work performed under Contract #W-31-109-Eng-52 between the Atomic Energy Commission and General Electric Company

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U. S. Department of Commerce
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ABSTRACT

Barley and bean plants were grown to maturity (87 days) in soil from a Pacific island which contained fallout material from the Bravo shot. The leaves of bean and barley plants showed a concentration factor of 0.05 and 0.02, respectively, for the total beta emitters absorbed.

Leaves of both bean and barley plants had a higher concentration of fission products than did the fruit. Addition of nutrients to the soil decreased the uptake of fission products into the bean plant but had no effect on uptake into barley.

With the exception of those for cesium, concentration factors for the individual elements were comparable with values previously obtained in the laboratory using local soils. The concentration factor of 4-8 for cesium is over 20 times higher than is obtained using local soils. All values are determined on oven dried material.

TABLE 3

CONCENTRATIONS OF EMITTERS FOUND IN BRAVO SOIL AND 87-DAY-OLD PLANTS GROWN IN THIS SOIL, EITHER WITH OR WITHOUT ADDED NUTRIENT

Element	Soil	With Nutrient				Without Nutrient			
		Bean		Barley		Bean		Barley	
		Leaves	Pods	Leaves	Heads	Leaves	Pods	Leaves	Heads
	mμc/g	CF*	CF	CF	CF	CF	CF	CF	CF
Rare Earths and yttrium	30	0.007	0.002	0.007	0.001	0.03	0.003	0.002	0.002
$Sr^{89 \text{ and } 90}$	0.2	7	1	3.5	0.5	15	2	5	0.4
Zr^{95}	4	0.008	0.005	0.01	0.003	0.03	0.008	0.02	0.01
Cs^{137}	0.1	1	2	Not determined	3	5	6	8	5
$Ru^{103-106}$	0.8	0.04	0.01	0.04	0.04	0.51	0.03	0.05	0.03

*Concentration factor expressed as $\frac{\mu c/g \text{ in plant part}}{\mu c/g \text{ in soil}}$ on dry weight basis.

HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

HW-33681

THE UPTAKE OF IODINE BY HIGHER PLANTS

A. A. Selders and J. H. Rediske
Plant Nutrition and Microbiology Unit
Biology Section

September 30, 1954

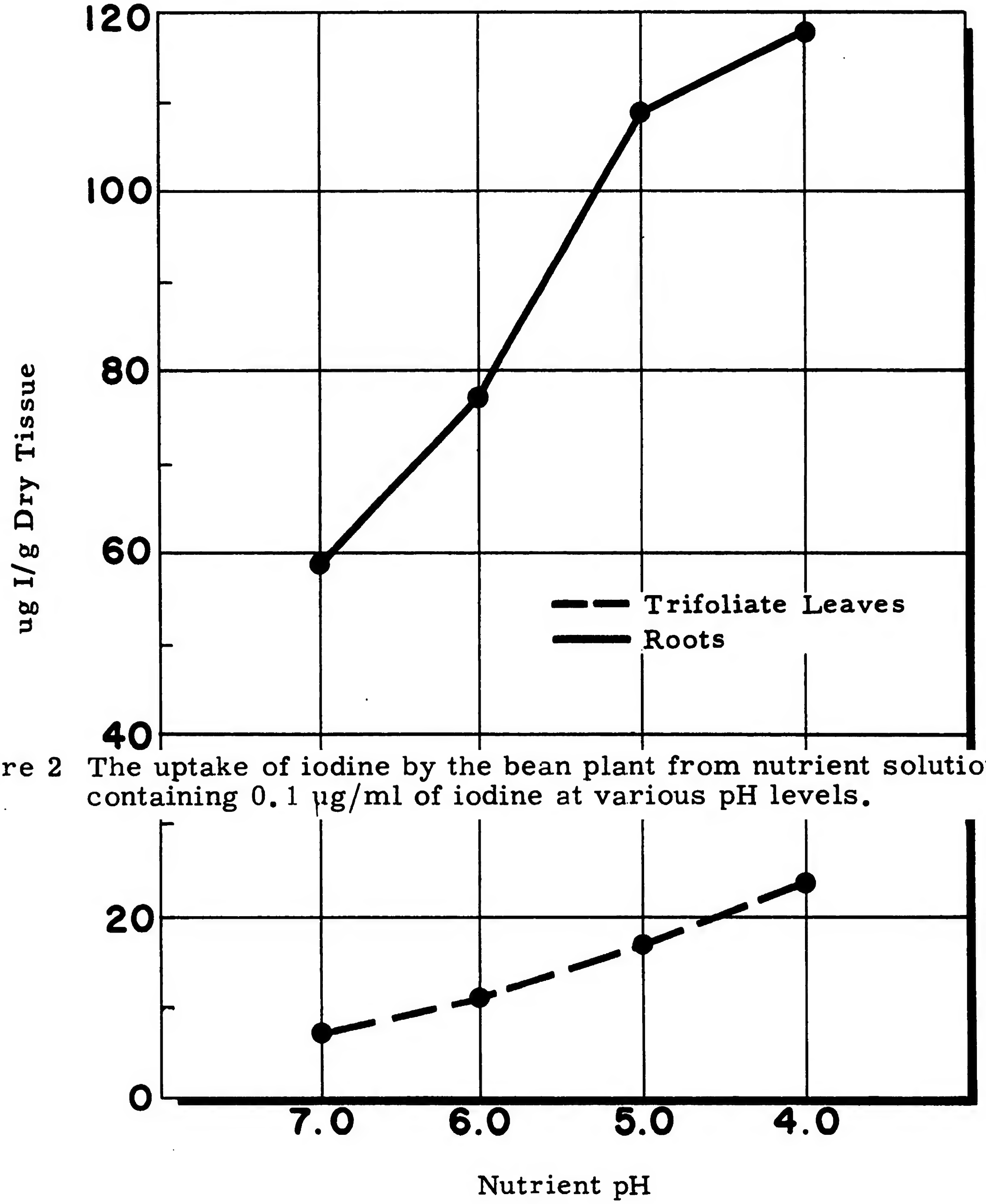

Figure 2 The uptake of iodine by the bean plant from nutrient solutions containing 0.1 μg/ml of iodine at various pH levels.

Survival of Food Crops and Livestock in the Event of Nuclear War

Proceedings of a symposium held at
Brookhaven National Laboratory
Upton, Long Island, New York
September 15–18, 1970

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Editors

David W. Bensen
Office of Civil Defense
Arnold H. Sparrow
Brookhaven National Laboratory

December 1971

U. S. ATOMIC ENERGY COMMISSION Office of Information Services

THE SIGNIFICANCE OF LONG-LIVED NUCLIDES AFTER A NUCLEAR WAR

R. SCOTT RUSSELL, B. O. BARTLETT, and R. S. BRUCE
Agricultural Research Council, Letcombe Laboratory, Wantage, Berkshire, England

ABSTRACT

The radiation doses from the long-lived nuclides ^{90}Sr and ^{137}Cs, to which the surviving population might be exposed after a nuclear war, are considered using a new evaluation of the transfer of ^{90}Sr into food chains.

As an example, it is estimated that, in an area where the initial deposit of near-in fallout delivered 100 R/hr at 1 hr and there was subsequent worldwide fallout from 5000 Mt of fission, the dose commitment would be about 2 rads to the bone marrow of the population and 1 rad to the whole body. Worldwide fallout would be responsible for the major part of these doses.

It is now widely recognized that long-lived fission products would make a negligible contribution to the radiation exposure of the population in heavily contaminated areas shortly after a nuclear attack. The external radiation dose would usually be dominant, and, if simple precautions were taken to avoid the superficial contamination of foodstuffs, the entry of ^{131}I into milk would cause the only important problem of dietary contamination. Thus, for example, infants probably would not receive doses of more than 0.1 rad to bone marrow from ^{90}Sr nor more than 0.01 rad from ^{137}Cs in the weeks after a nuclear attack if they were fed continuously with milk produced in an area where the external dose rate at 1 hr after detonation had been 100 R/hr. Doses to the thyroid from ^{131}I might, however, exceed 200 rads.

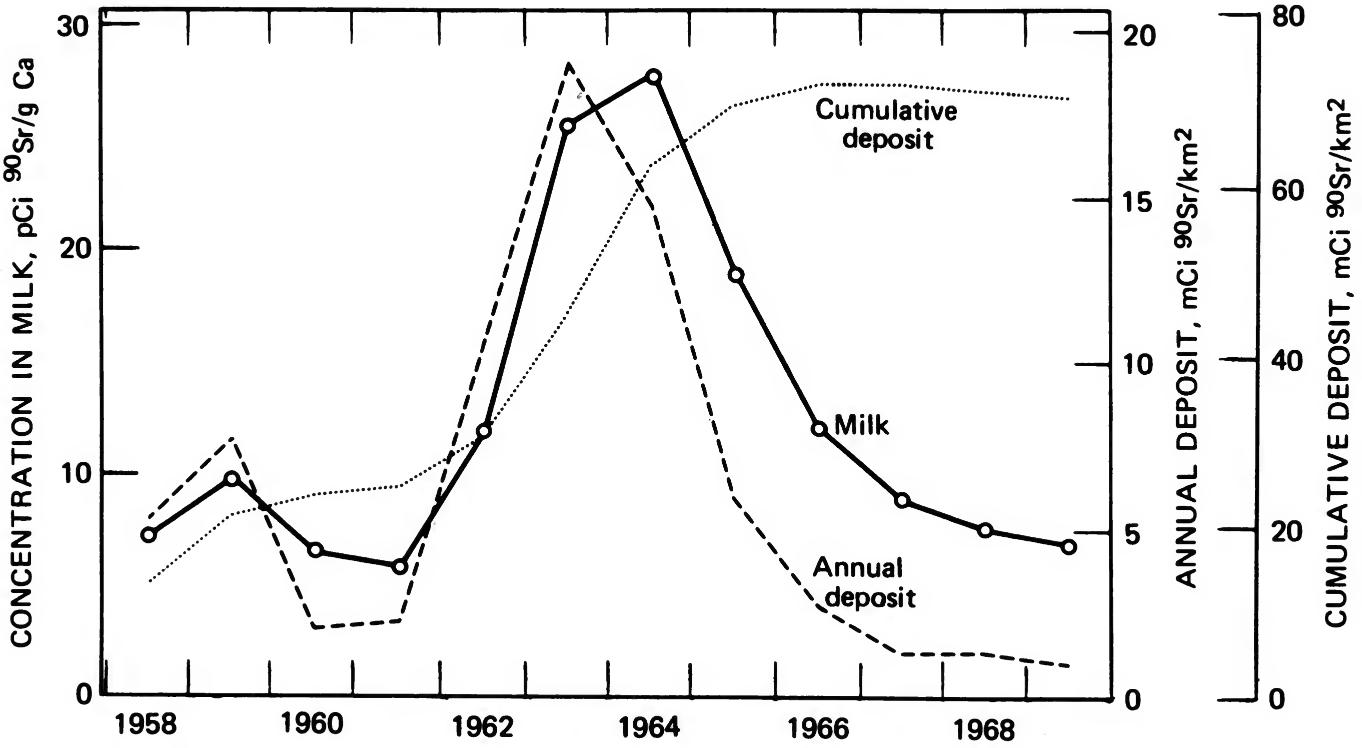


Fig. 1 Strontium-90 in fallout and milk in the United Kingdom, 1958 to 1969.

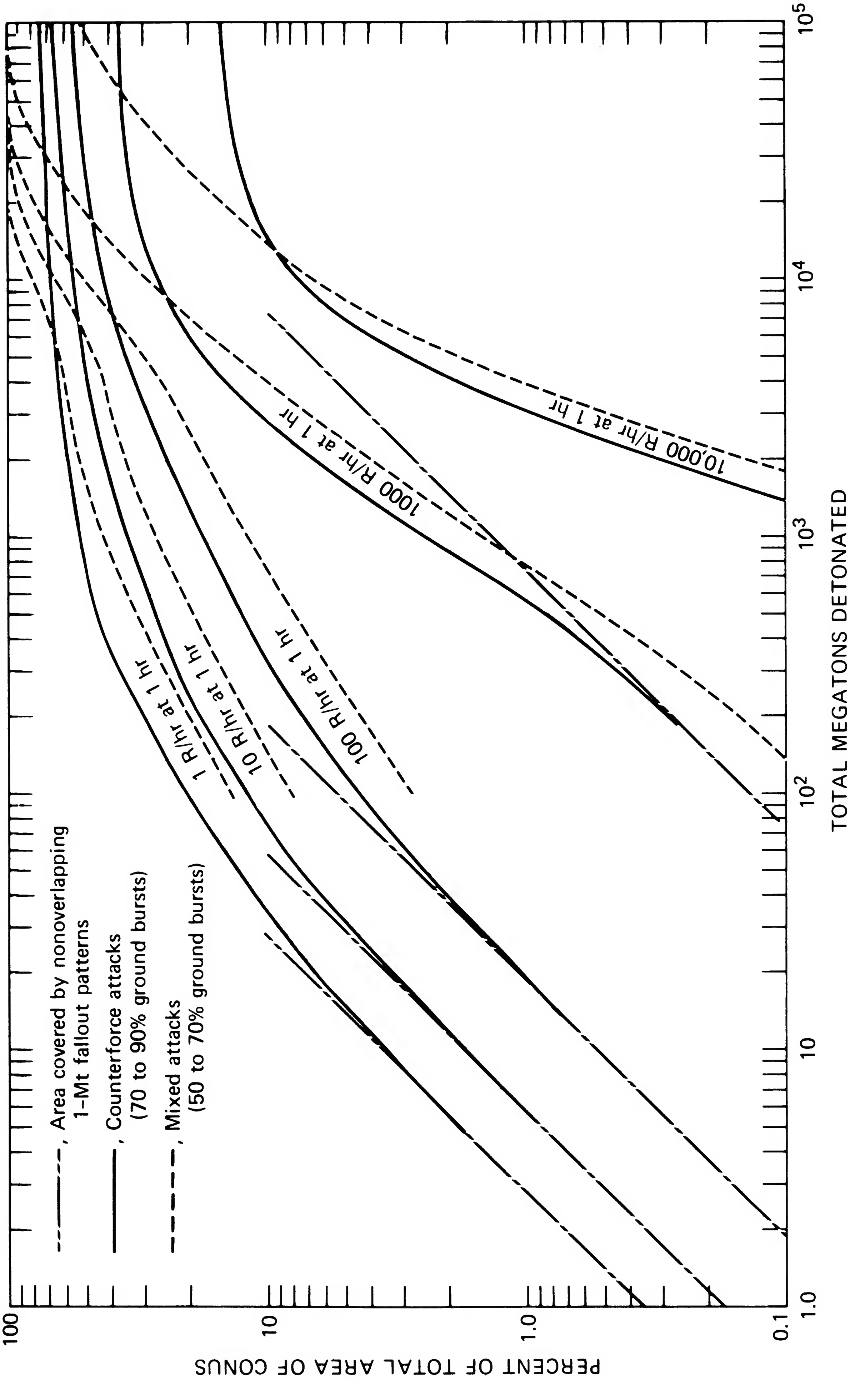
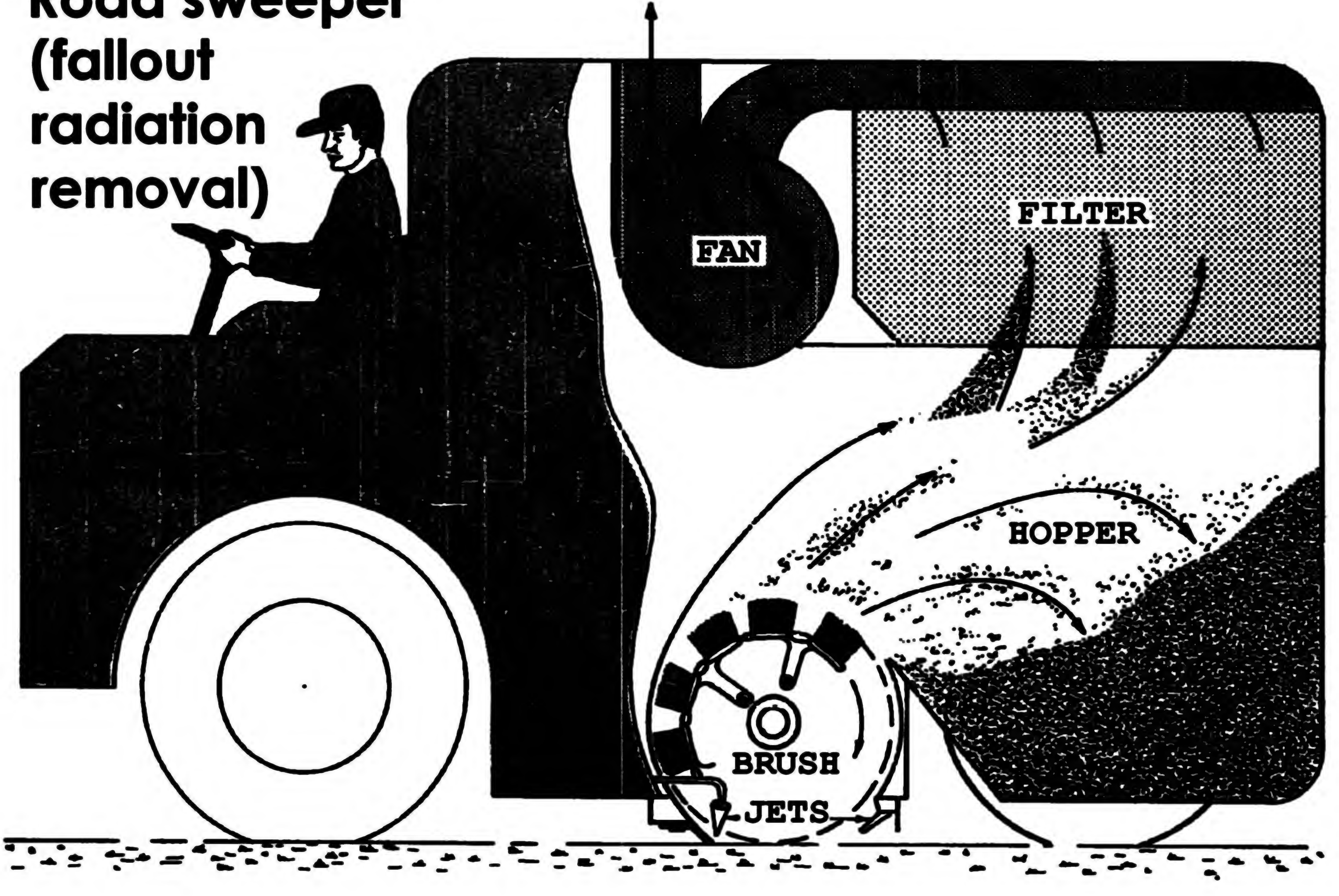


Fig. 1 Percent of area of the continental United States enclosed within selected I_s contours as a function of attack weight (50% fission weapons).

Road sweeper (fallout radiation removal)




TRINITY GROUND ZERO:
8000 R/hr at 1 hour
1.4 R/hr at
57 days
11 Sept. 1945

CLEAN BOMB: 3.53 MT (15% FISSION) ZUNI

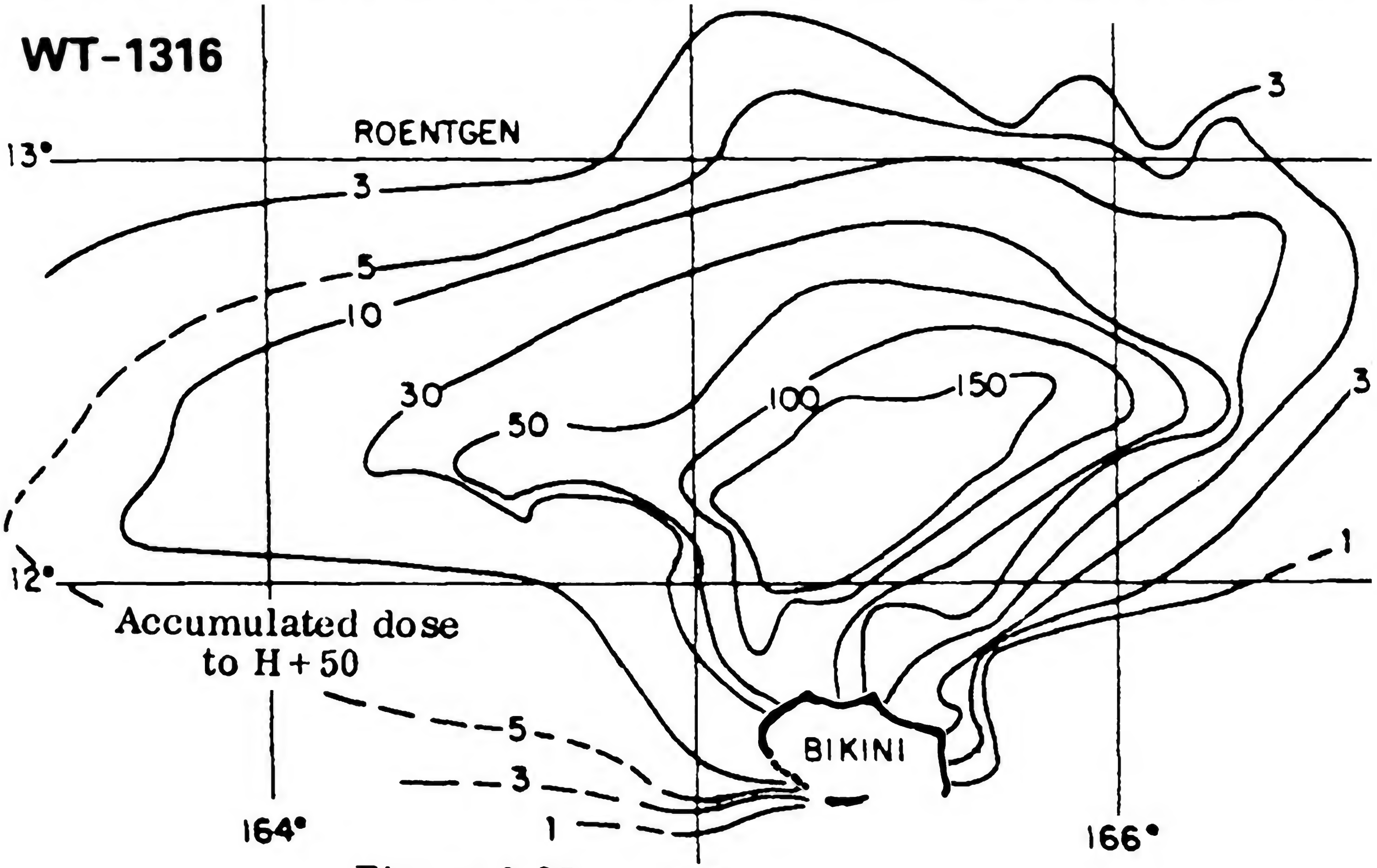


Figure 2.37

DIRTY BOMB: 5.01 MT (87% FISSION) TEWA

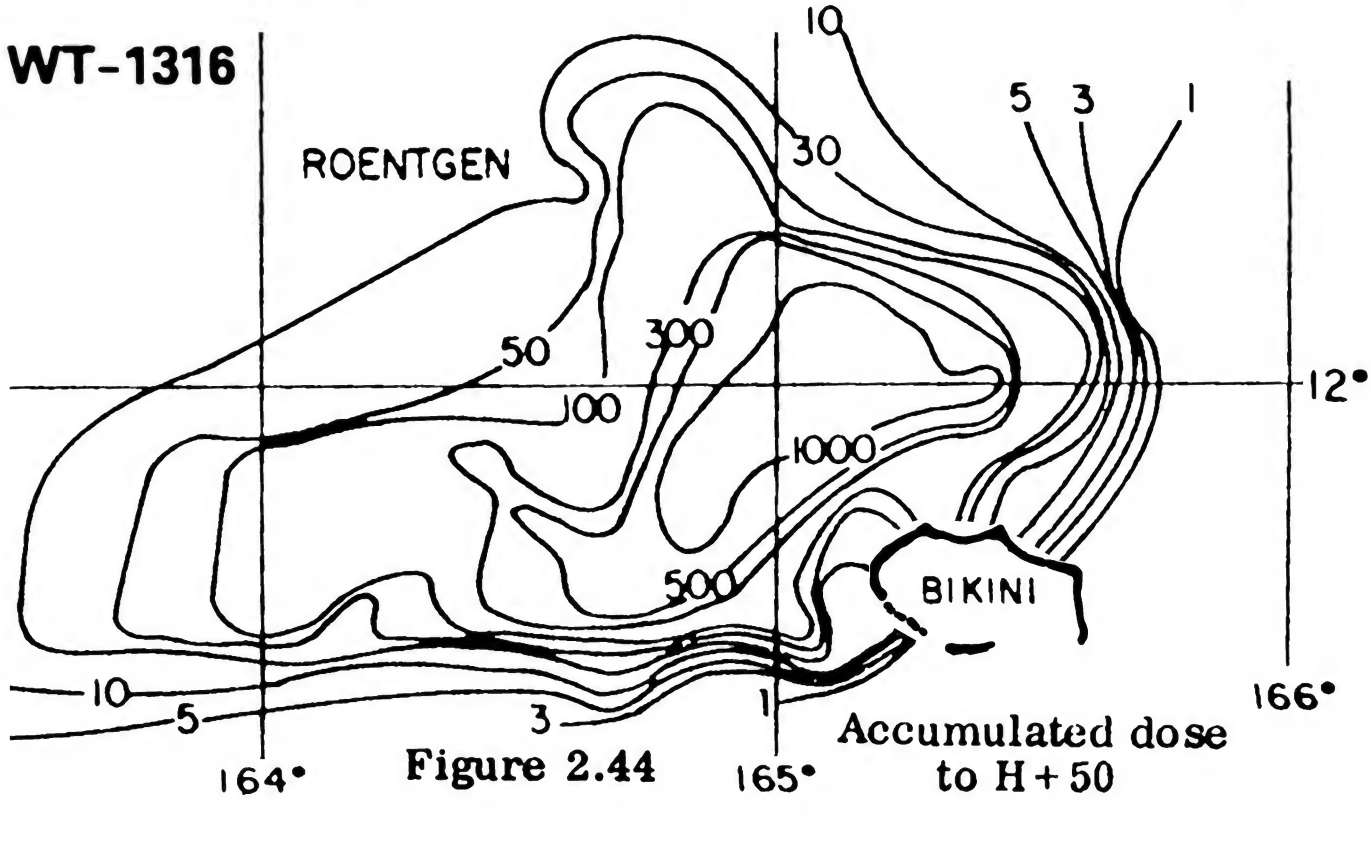


Figure 2.44

WT-1316 TABLE 2.11

	Navajo	Tewa
Total Yield, Mt	4.50	5.01
Fission proportion	5% (CLEAN)	87% (DIRTY)

H + 1 Hour Dose Rate (r/hr)	Area (mi^2) Within Contour	
1,000	25	450
500	55	1,050
300	80	1,550
100	310	3,500

Two-day Dose, R	Area (mi^2) Within Contour	
1,000	20	520
500	30	1,050
300	45	1,500
100	350	3,000

LAND SURFACE BURST

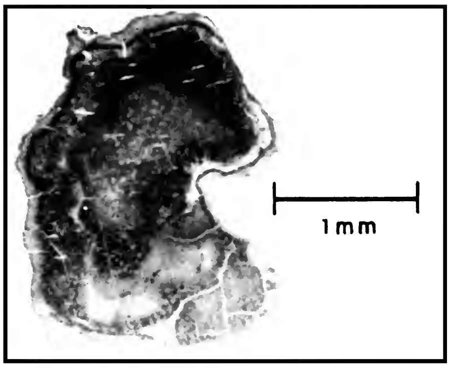
A FALLOUT FORECASTING TECHNIQUE WITH RESULTS OBTAINED AT THE ENIWETOK PROVING GROUND

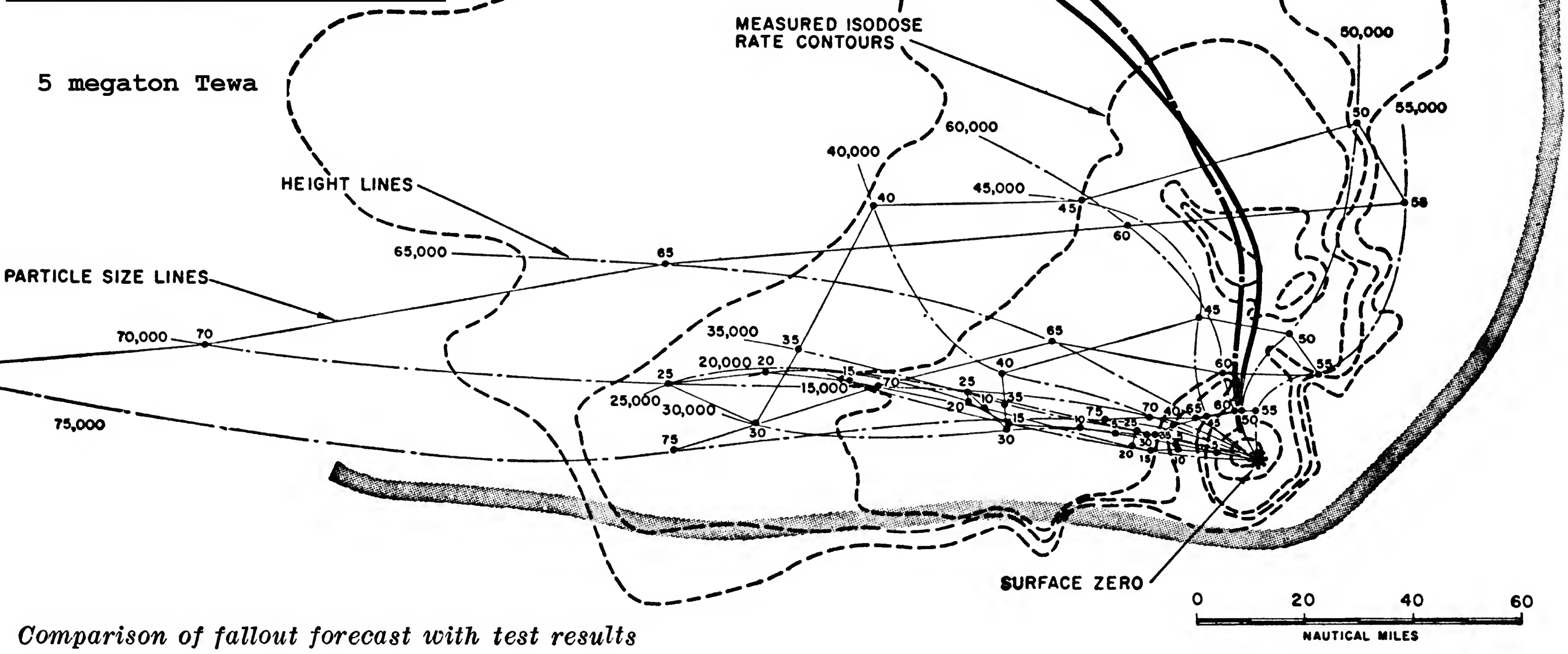
E. A. Schuert, USNRDL TR-139, United States Naval Radiological Defense Laboratory, San Francisco, Calif.

2.36 g/cu cm irregular in shape

Falling speeds (feet/hour)

Altitude	75 μ	100 μ	200 μ	350 μ
0	3,060	5,040	11,700	21,600
20	3,360	5,980	14,400	27,100
40	3,870	6,910	18,600	35,300
60	4,200	7,700	24,400	47,200
80	3,910	6,960	27,800	61,900

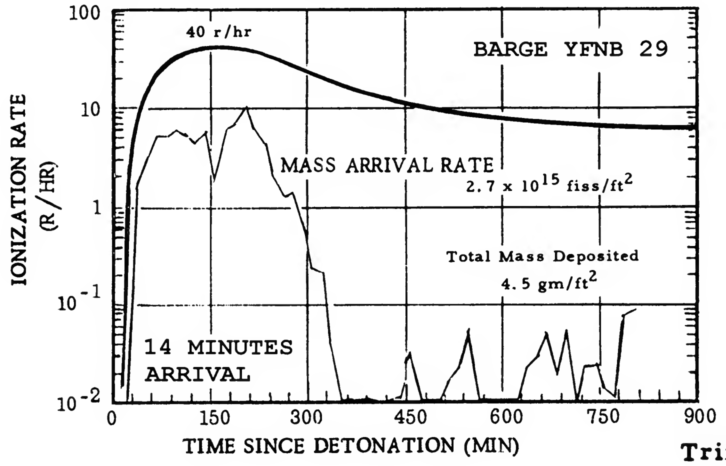




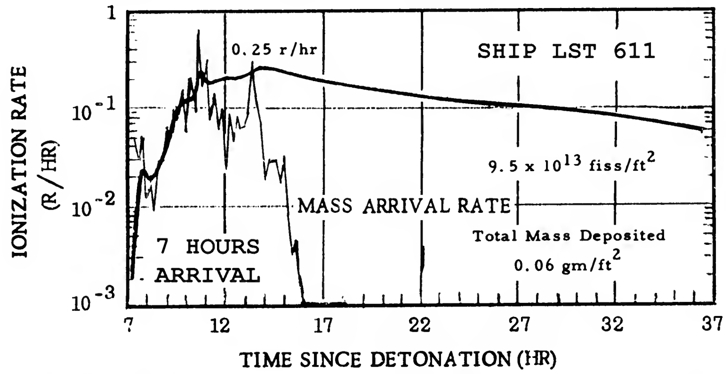
Comparison of fallout forecast with test results

HEIGHT LINE = DESTINATIONS FOR A FIXED HEIGHT OF ORIGIN FOR VARIOUS SIZES
SIZE LINE = DESTINATIONS FOR A FIXED PARTICLE SIZE FROM VARIOUS HEIGHTS
HOT LINE = HEIGHT LINE FROM BASE OF MUSHROOM DISC (MAXIMUM FALLOUT)

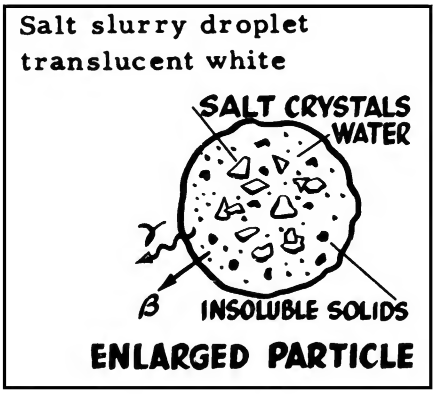
5 MT TEWA (87% FISSION), 7.84 STAT. MILES WSW



5 MT TEWA (87% FISSION), 59.3 STAT. MILES NW



Triffet, T. and LaRiviere, P. D.; Characterization of Fallout



WATER SURFACE BURST

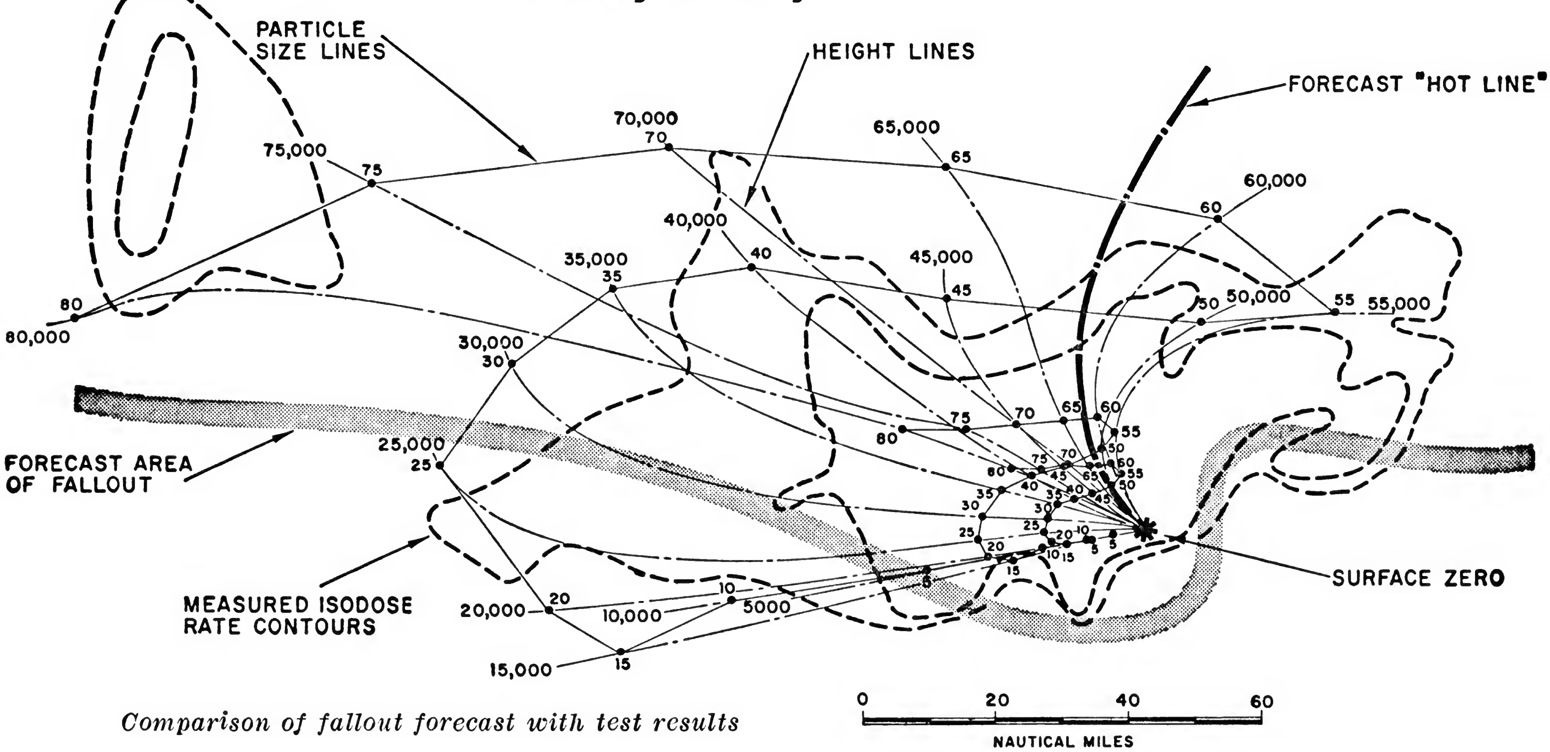
A FALLOUT FORECASTING TECHNIQUE WITH RESULTS OBTAINED AT THE ENIWETOK PROVING GROUND

E. A. Schuert, USNRDL TR-139, United States Naval Radiological Defense Laboratory, San Francisco, Calif.

Time variation of the winds aloft

In most of the observations made at the Eniwetok Proving Ground, the winds aloft were not in a steady state. Significant changes in the winds aloft were observed in as short a period as 3 hours. This variability was probably due to the fact that proper firing conditions which required winds that would deposit the fallout north of the proving ground, occurred only during an unstable synoptic situation of rather short duration.

4.5 megaton Navajo



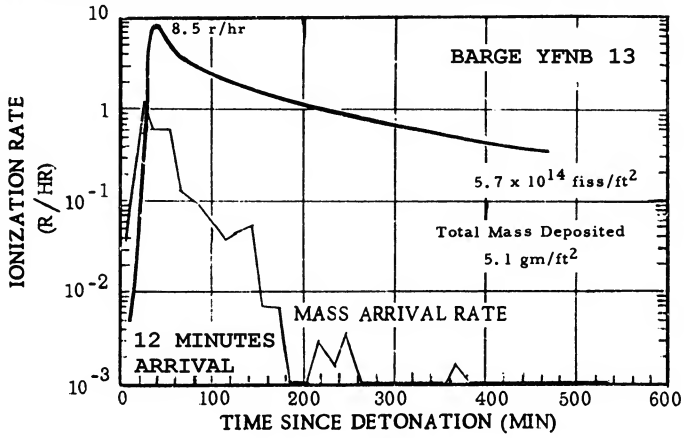
Comparison of fallout forecast with test results

HEIGHT LINE = DESTINATIONS FOR A FIXED HEIGHT OF ORIGIN FOR VARIOUS SIZES

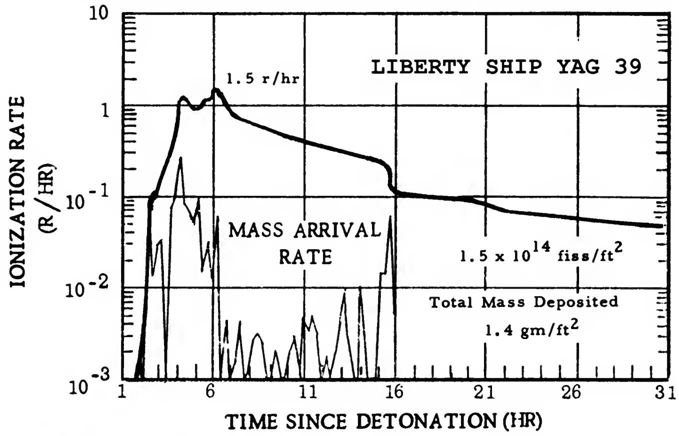
SIZE LINE = DESTINATIONS FOR A FIXED PARTICLE SIZE FROM VARIOUS HEIGHTS

HOT LINE = HEIGHT LINE FROM BASE OF MUSHROOM DISC (MAXIMUM FALLOUT)

4.5 MT NAVAJO (5% FISSION), 7.54 STAT. MILES W



4.5 MT NAVAJO (5% FISSION), 21.0 STAT. MILES N

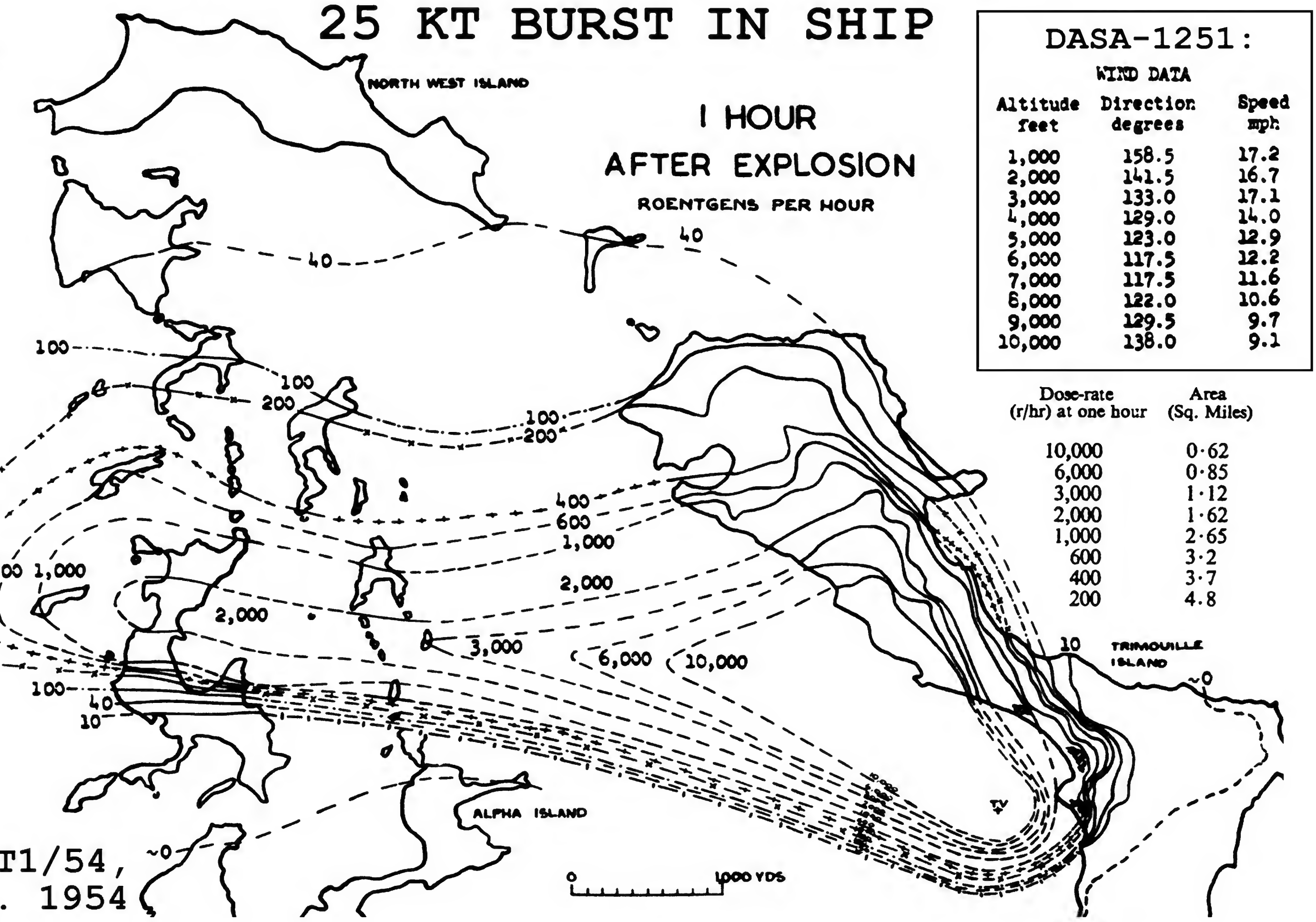


Triffet, T. and LaRiviere, P. D.; Characterization of Fallout, Project 2.63

OPERATION HURRICANE—THE DOSE-RATE CONTOURS OF THE RESIDUAL RADIOACTIVE CONTAMINATION

25 KT BURST IN SHIP

FIG. 7·2



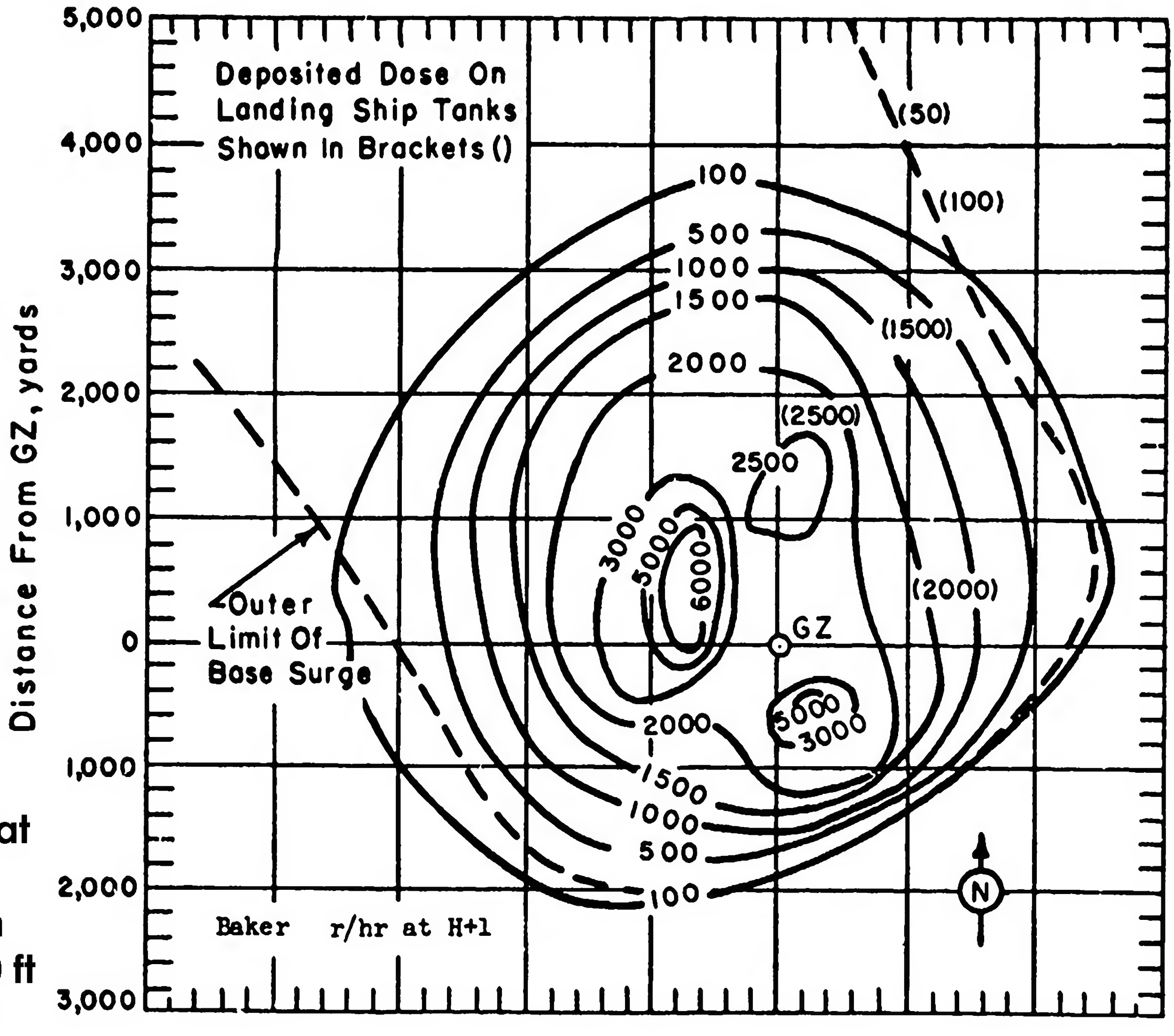
DASA-1251:

WIND DATA

Altitude feet	Direction degrees	Speed mph
1,000	158.5	17.2
2,000	141.5	16.7
3,000	133.0	17.1
4,000	129.0	14.0
5,000	123.0	12.9
6,000	117.5	12.2
7,000	117.5	11.6
8,000	122.0	10.6
9,000	129.5	9.7
10,000	138.0	9.1

Dose-rate (r/hr) at one hour	Area (Sq. Miles)
10,000	0·62
6,000	0·85
3,000	1·12
2,000	1·62
1,000	2·65
600	3·2
400	3·7
200	4·8

AWRE-T1/54, 27 Aug. 1954



23 kt at 90 ft depth in 180 ft water

AD-A995490

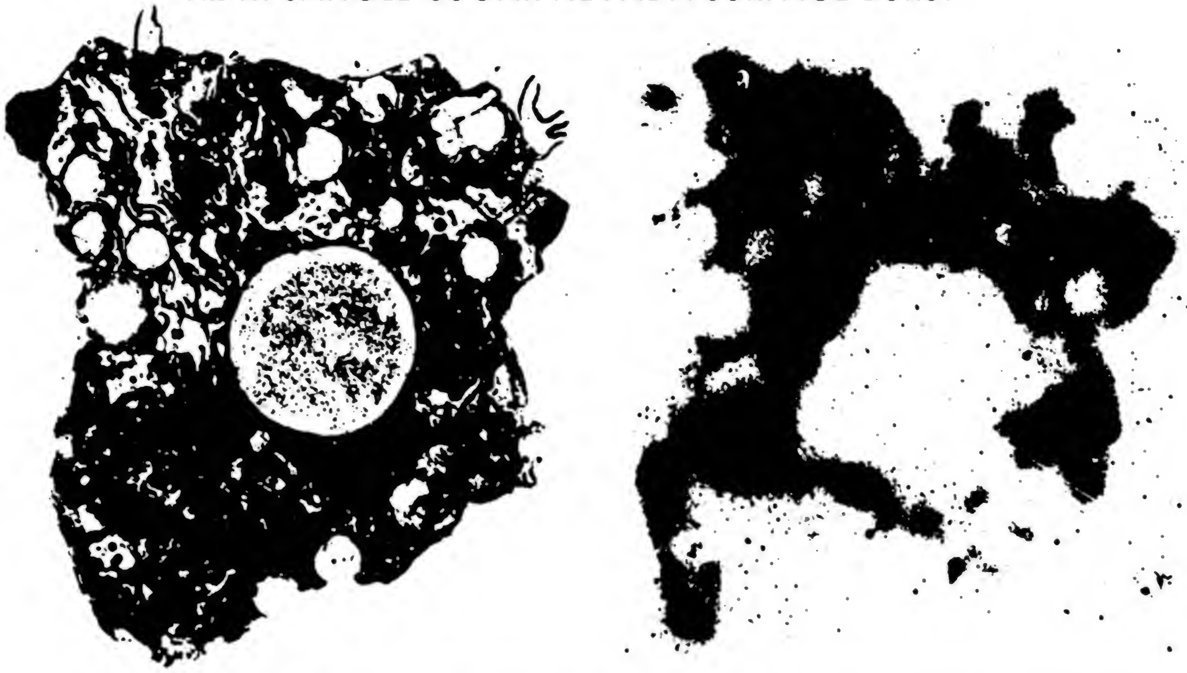
POR-2266 (WT-2266)

TABLE 4.1 AREAS ENCLOSED BY DOSE RATE CONTOURS

Contour Dose Rate, I	Area Within Contour			
	0.018 kt	0.022 kt	0.5 kt	1.65 kt
	Little Feller I	Little Feller II	Johnie Boy	Small Boy
r/hr	mi^2	mi^2	mi^2	mi^2
0.5	0.33	0.827	-	109.83
1.0	0.208	0.469	33.097	61.63
5.0	-	0.070	-	-
10.0	0.032	0.045	3.924	9.057
20.0	-	0.019	-	-
50.0	-	-	0.536	2.954
100.0	0.00478	0.005	0.214	1.200
200.0	-	-	-	0.285
1,000.0	-	-	0.0917	0.092
2,000.0	-	-	-	0.01665
10,000.0	-	-	0.0161	-
17,000.0	-	-	0.00537	-

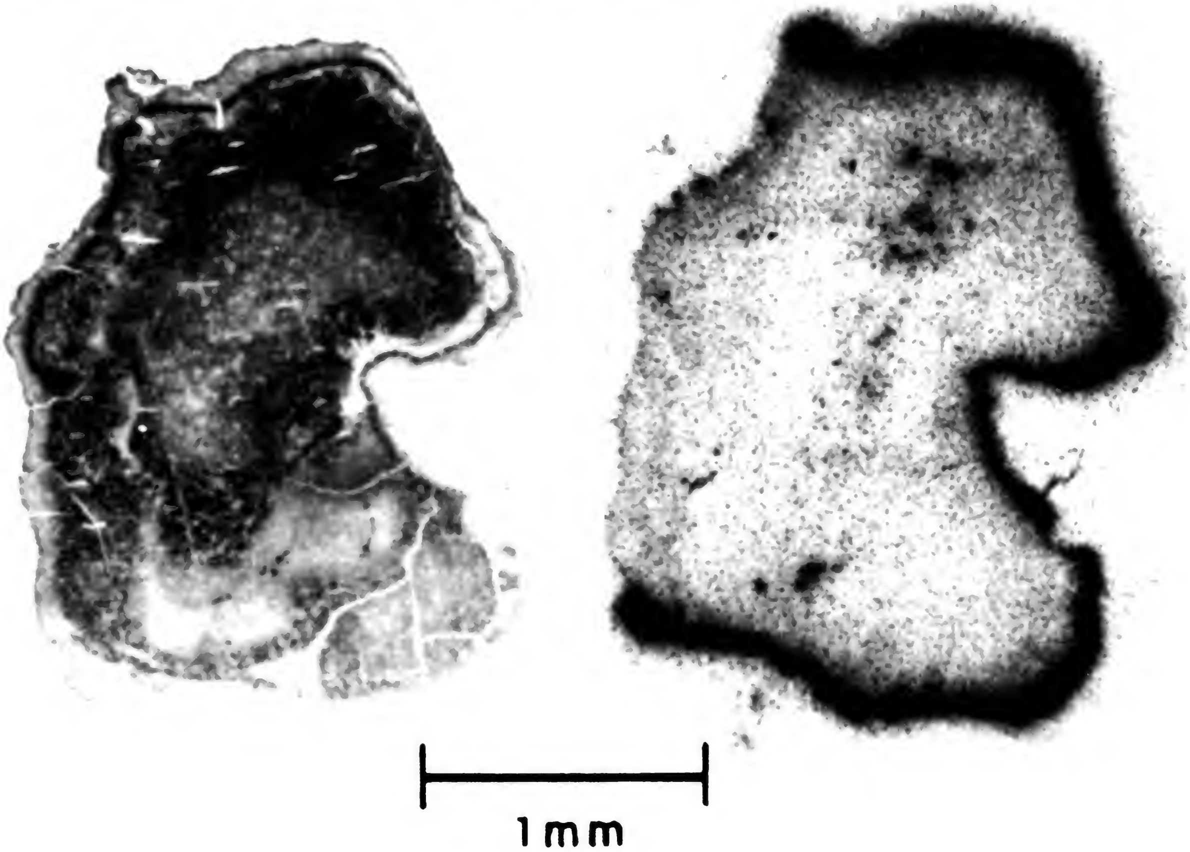
THIN SECTION AND RADIOGRAPH OF A FALLOUT PARTICLE FROM A SMALL-YIELD SURFACE SHOT AT THE NEVADA TEST SITE. THE PARTICLE IS A TRANSPARENT YELLOW-BROWN GLASS WITH MANY INCLUSIONS OF GAS BUBBLES AND UNMELTED MINERAL GRAINS. THE RADIOACTIVITY IS DISTRIBUTED IRREGULARLY THROUGHOUT THE GLASS PHASE OF THE PARTICLE

1.2 KT JANGLE-SUGAR NEVADA SURFACE BURST



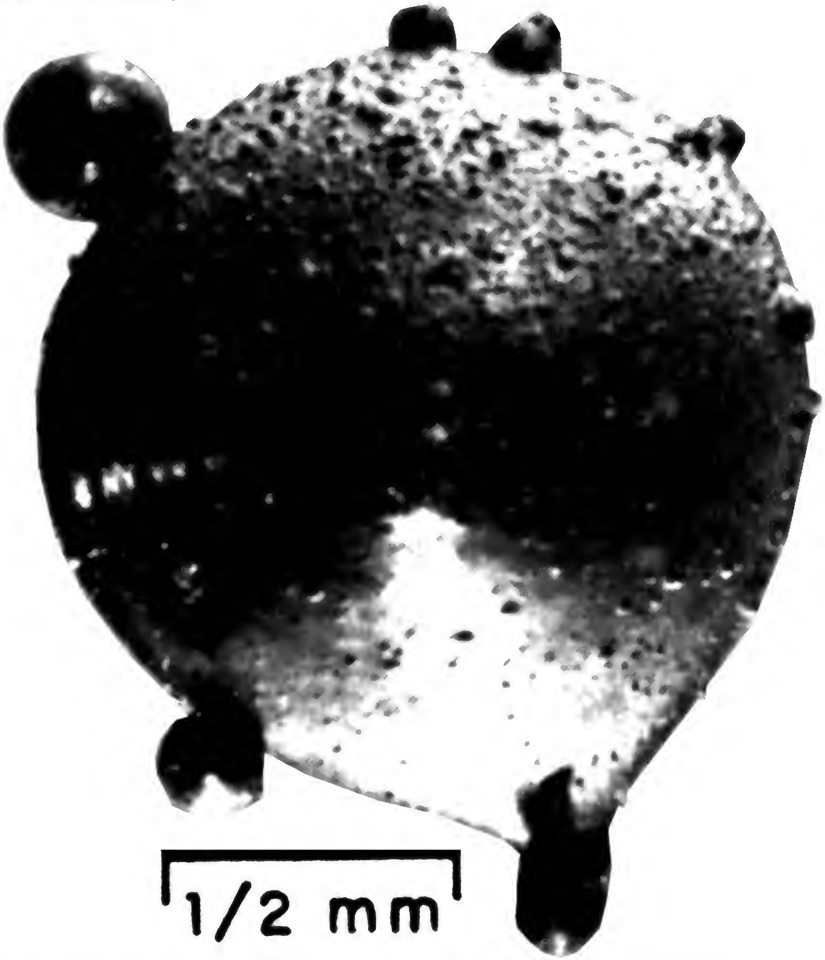
C.E. Adams, et al. The Nature of Individual Radioactive Particles. I. Surface and Underground A.B.D. Particles From Operation JANGLE. U.S. Naval Radiological Defense Laboratory Report, USNRDL-374, November 28, 1952

THIN SECTION AND RADIOGRAPH OF AN ANGULAR FALLOUT PARTICLE FROM A LARGE-YIELD SURFACE SHOT AT THE ENIWETOK PROVING GROUNDS. THIS PARTICLE IS COMPOSED ALMOST ENTIRELY OF CALCIUM HYDROXIDE WITH A THIN OUTER LAYER OF CALCIUM CARBONATE. THE RADIOACTIVITY HAS COLLECTED ON THE SURFACE AND HAS DIFFUSED A SHORT DISTANCE INTO THE PARTICLE

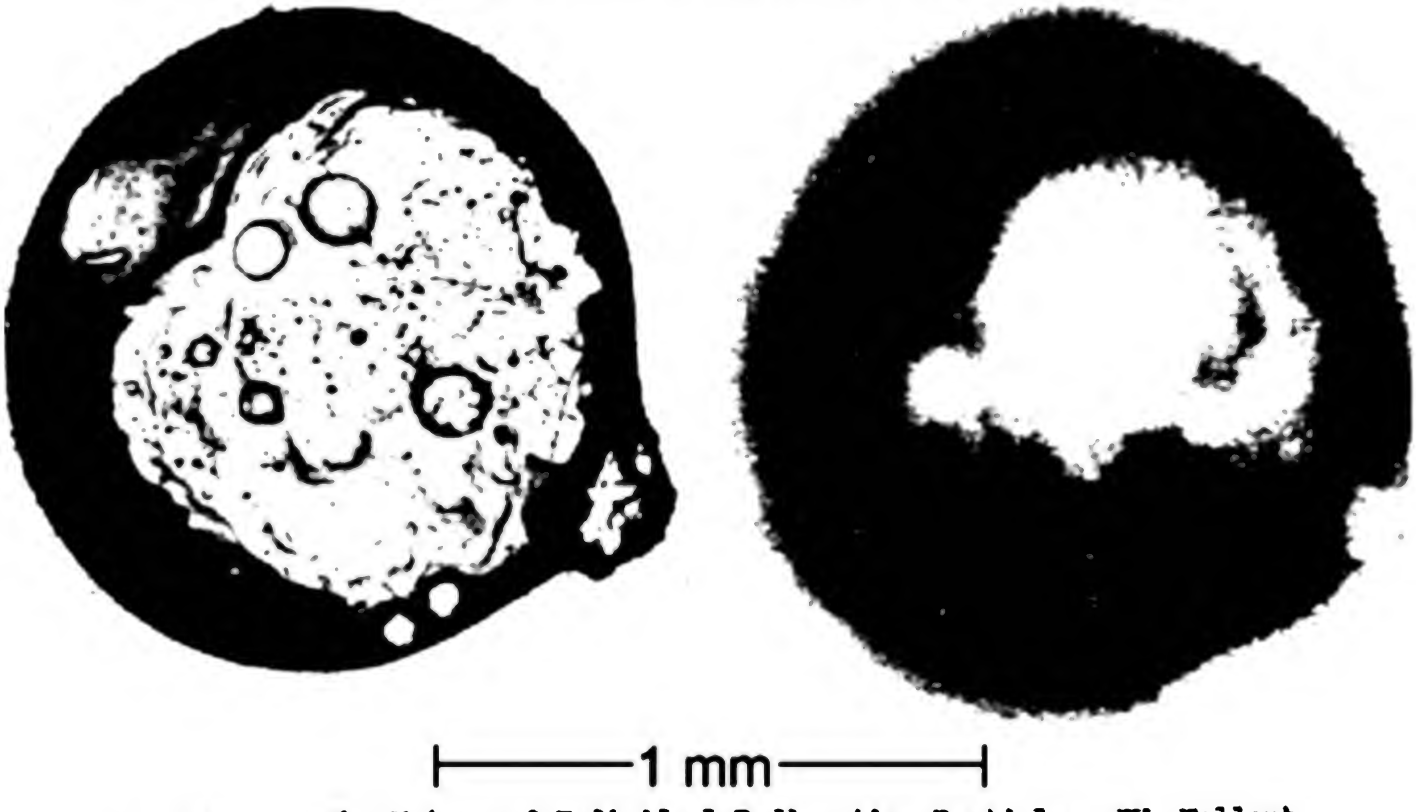


TWO FALLOUT PARTICLES FROM A TOWER SHOT AT THE NEVADA TEST SITE. THE PARTICLE ON THE LEFT IS A PERFECT SPHERE WITH A HIGHLY GLOSSY SURFACE; THE ONE ON THE RIGHT HAS MANY PARTIALLY-ASSIMILATED SMALLER SPHERES ATTACHED TO ITS SURFACE. BOTH PARTICLES ARE BLACK AND MAGNETIC AND HAVE A SUPERFICIAL METALLIC APPEARANCE.

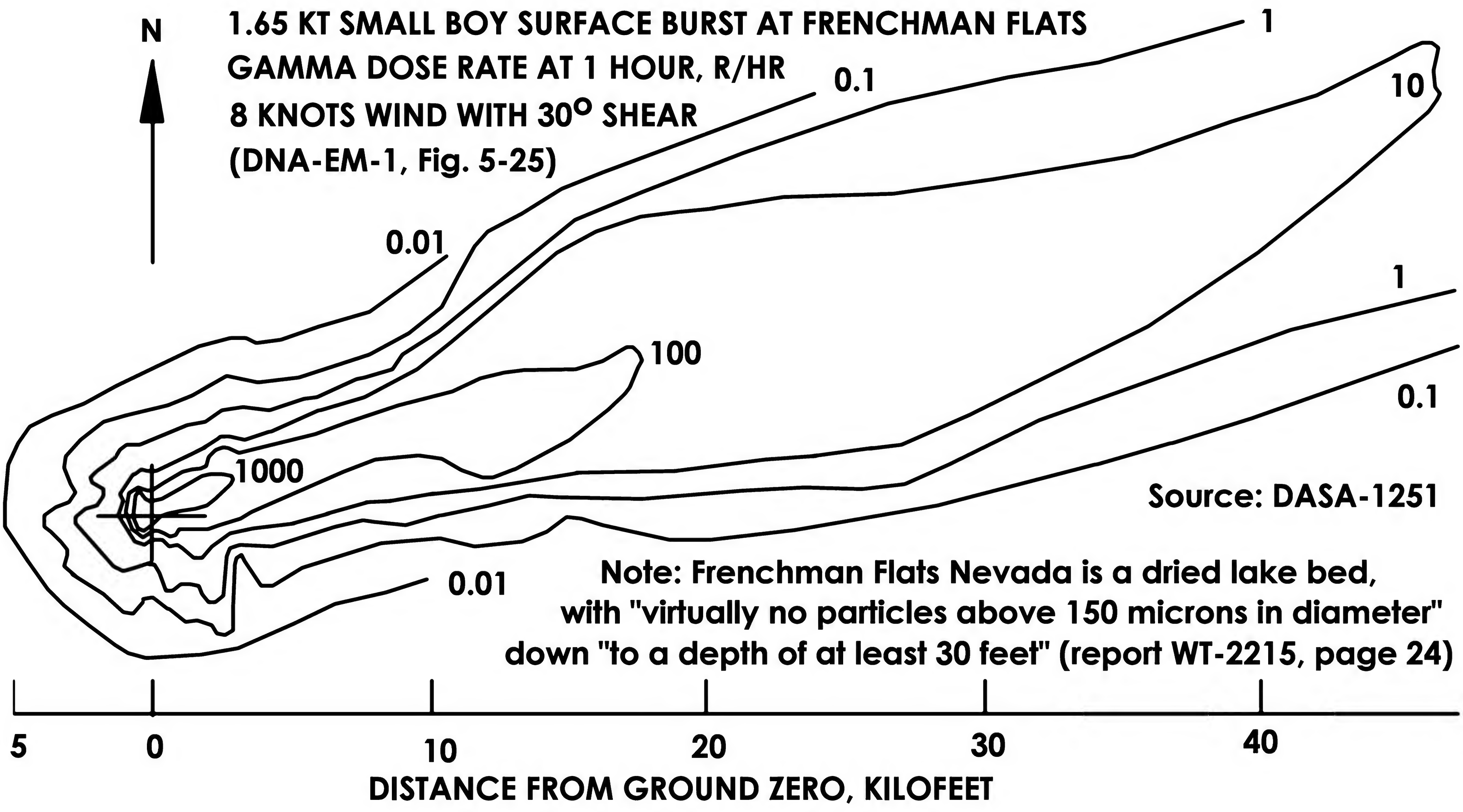
Shiny black marble (iron oxide in glass)



THIN SECTION AND RADIOGRAPH OF A FALLOUT PARTICLE FROM A MODERATE-YIELD TOWER SHOT AT THE NEVADA TEST SITE. THIS PARTICLE IS COMPOSED OF A TRANSPARENT GLASS CORE WITH A DARKLY COLORED IRON OXIDE GLASS OUTER ZONE. MOST OF THE RADIOACTIVITY IS CONCENTRATED IN THE OUTER ZONE

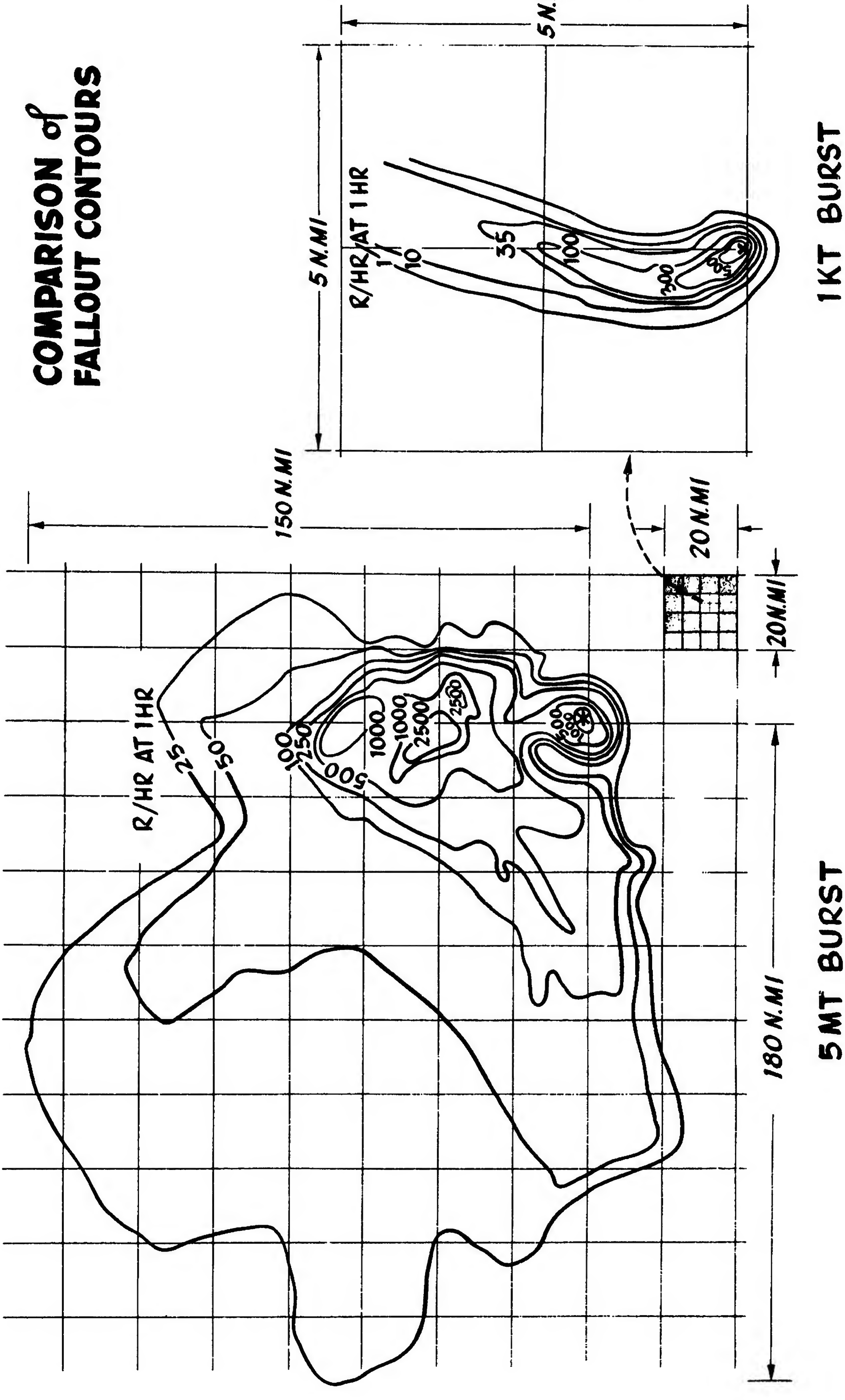


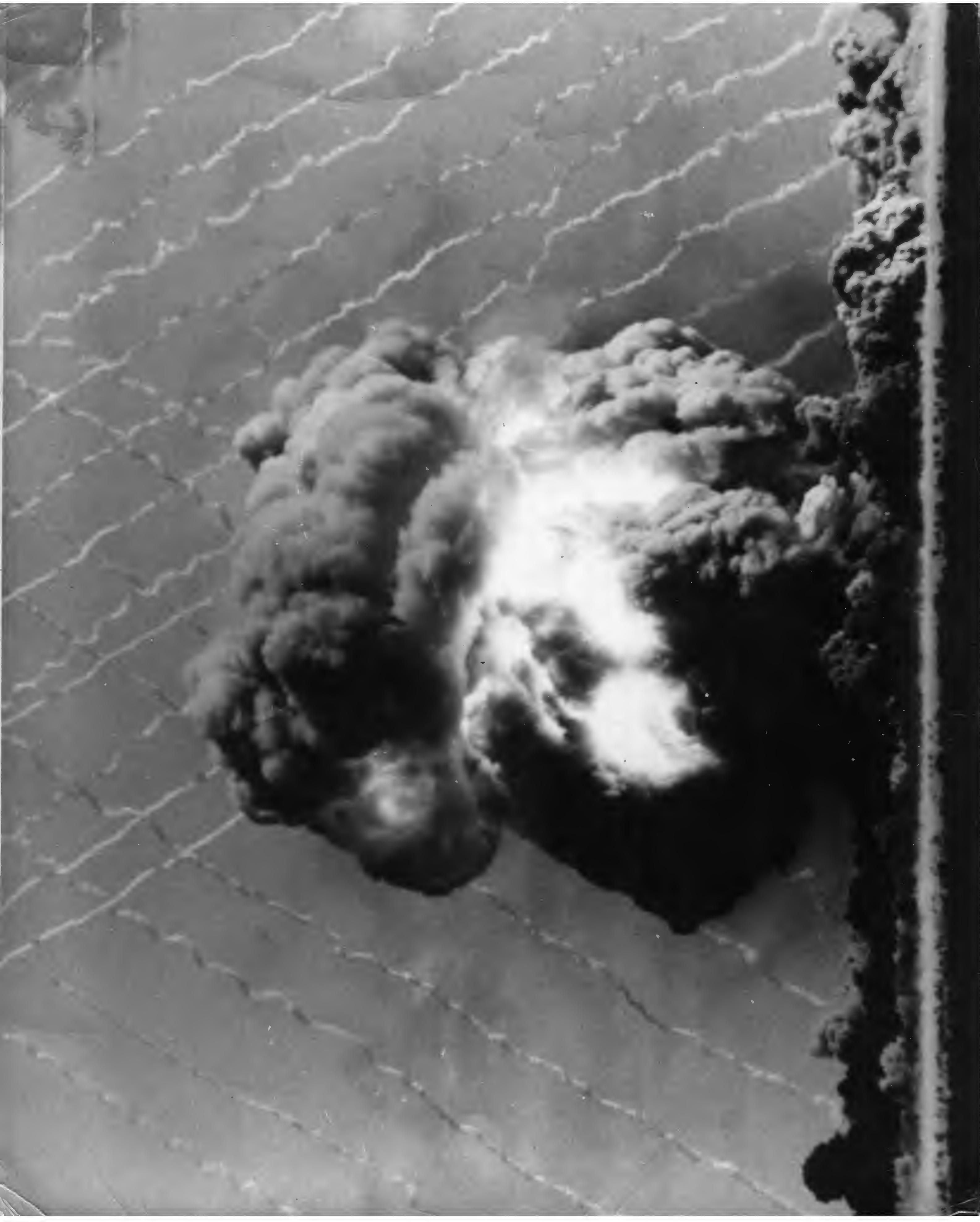
C.E. Adams. The Nature of Individual Radioactive Particles. IV. Fallout Particles From A.B.D. of Operation UPSHOT-KNOTHOLE. U.S. Naval Radiological Defense Laboratory Report, USNRDL-440, February 24, 1954



N
1.65 KT SMALL BOY SURFACE BURST AT FRENCHMAN FLATS
GAMMA DOSE RATE AT 1 HOUR, R/HR
8 KNOTS WIND WITH 30° SHEAR
(DNA-EM-1, Fig. 5-25)
1
0.1
10
0.01
1
100
0.1
1000
Source: DASA-1251
0.01
Note: Frenchman Flats Nevada is a dried lake bed,
with "virtually no particles above 150 microns in diameter"
down "to a depth of at least 30 feet" (report WT-2215, page 24)
5
0
10
20
30
40
DISTANCE FROM GROUND ZERO, KILOFEET

1.2 kt SUGAR (1951) and 5.01 Mt TEWA (87% fission)





Buffalo-1 at Maralinga, 1956. This nuclear test gave immense civil defence data.

Car (Land Rover jeep) in
Maralinga desert, 600m from 15kt
Buffalo-1 nuclear test

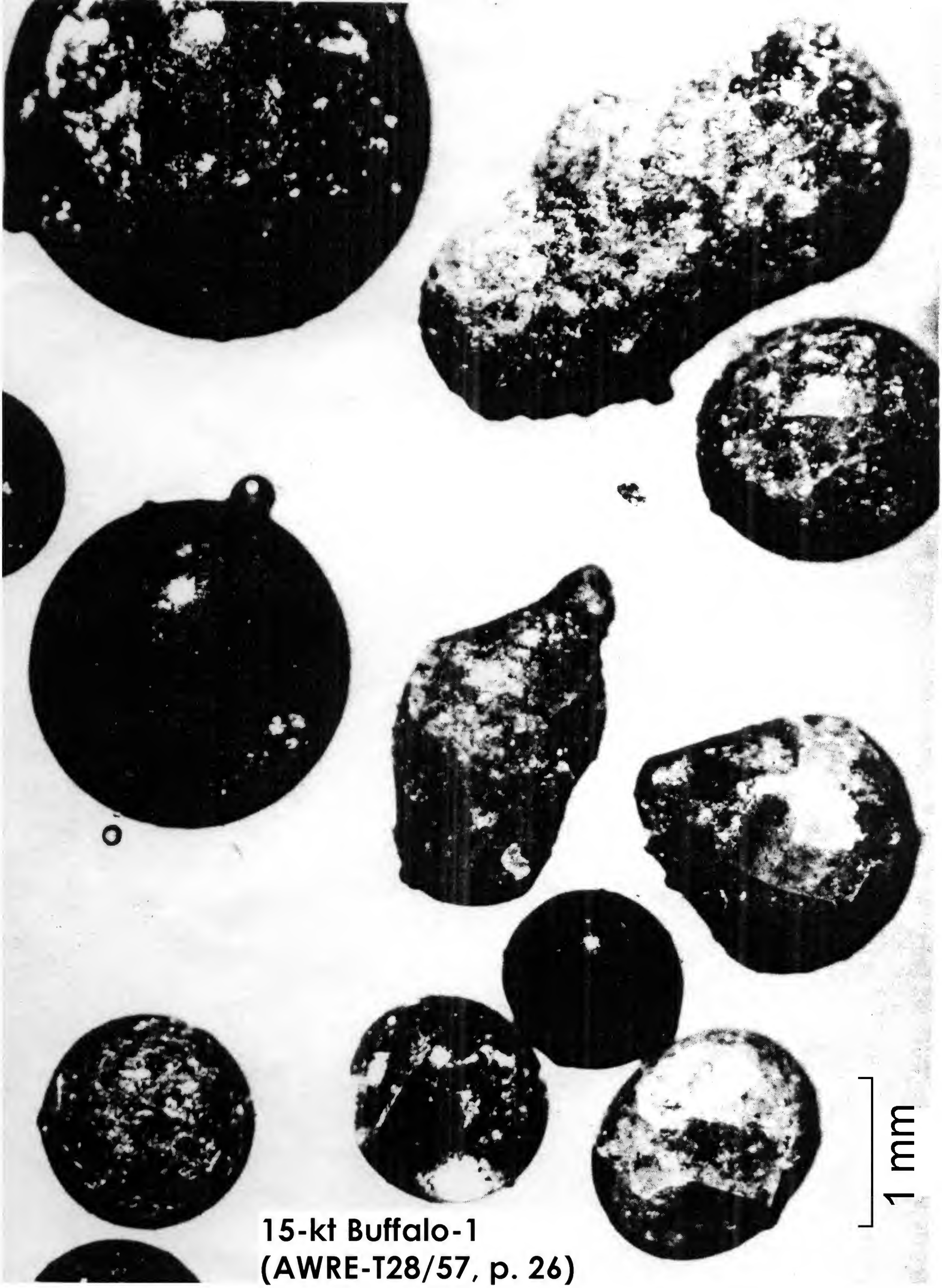
Blast precursor effect on car

Buffalo-1 at Maralinga, 1956. This nuclear test gave immense civil defence data.

Buffalo-1 vortex cloud forming as cooling fireball rises

Buffalo-1 nuclear test cloud reaching maximum altitude

Buffalo-1 nuclear test being dispersed by winds



NOT AN INVISIBLE GAS: FALLOUT FROM BUFFALO-1
Fallout from sandy soil was glassy marbles.

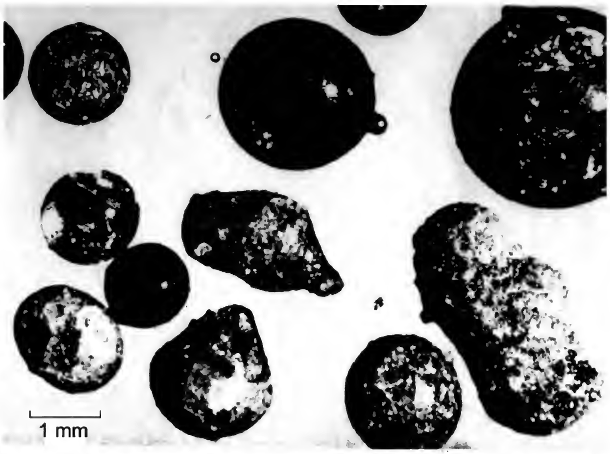
THE VISIBLE CONTAMINANT: SEEING FALLOUT

'Perhaps the most important application of radiological warfare would be its psychological effect as a mystery weapon, analogous to the initial use of poison gas and of tanks in World War I. The obvious method to combat radiological warfare in this case is to understand and be prepared for it.' – Dr Samuel Glasstone, Editor, *The Effects of Atomic Weapons,* Los Alamos Scientific Laboratory, September 1950, p. 289.

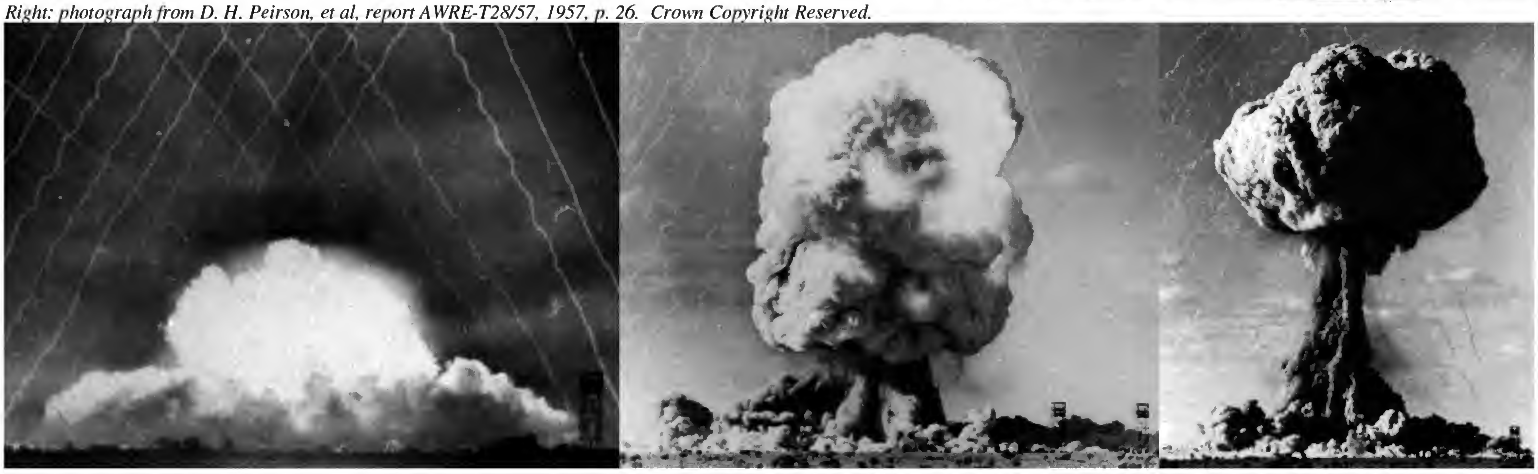
'Sampling stations were located ... aboard anchored barges, type YFNB, and manned ships ... Particles collected in the incremental type of collector were used ... particles could be classified by time of arrival. One of the ship sampling stations was connected by an elevator device to a radiation-shielded laboratory, permitting almost immediate examination of fallout samples.' – N.H. Farlow and W.R. Schell, U.S. Naval Radiological Defense Laboratory, technical report USNRDL-TR-170, 1957, p. 1.

Right: according to the popular superstition, you cannot *see, smell, hear*, or *feel* dangerous fallout, which is an invisible, mysterious, supernatural, all-pervading, fearful, death-ray weapon. This fiction came from two types of anti-nuclear propaganda: the first type confusing particles of radiation with particles of fallout, and the second type concerning the insignificantly radioactive (compared to background radiation), distant fallout from nuclear testing in the 1950s. The fact that data on the dangerous close in fallout was classified 'secret' did not help. The clearly visible nature of dangerous local fallout from the 15 kt Australian-British *Buffalo – One Tree* nuclear test (detonated on a 30.5 m high aluminium tower at Maralinga in Australia on 27 September 1956) is shown on the right. You can see this fallout forming in the fireball vortex photographs below.

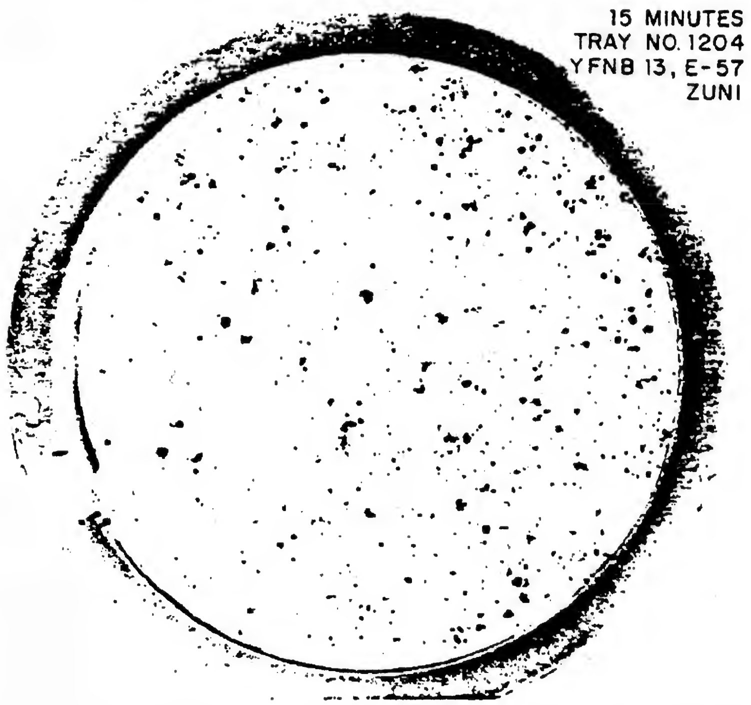
The fallout consists of a mixture of large, smooth, globular, glossy, spherical particles resulting from the solidification of melted silicate sand with molten aluminium oxide from the tower, and a variety of unmelted, irregular sand grains. You can *hear* this dangerous fallout hitting surfaces and bouncing. You can also *see, touch,* and *feel* the particles where there is an acute threat to life, but you will not smell them (because of gravity, the fallout particles do not tend to enter your nose!). The melted particles are contaminated with insoluble activity trapped throughout their fused volume. Contamination on unmelted particles is limited to the surface, but is relatively soluble.



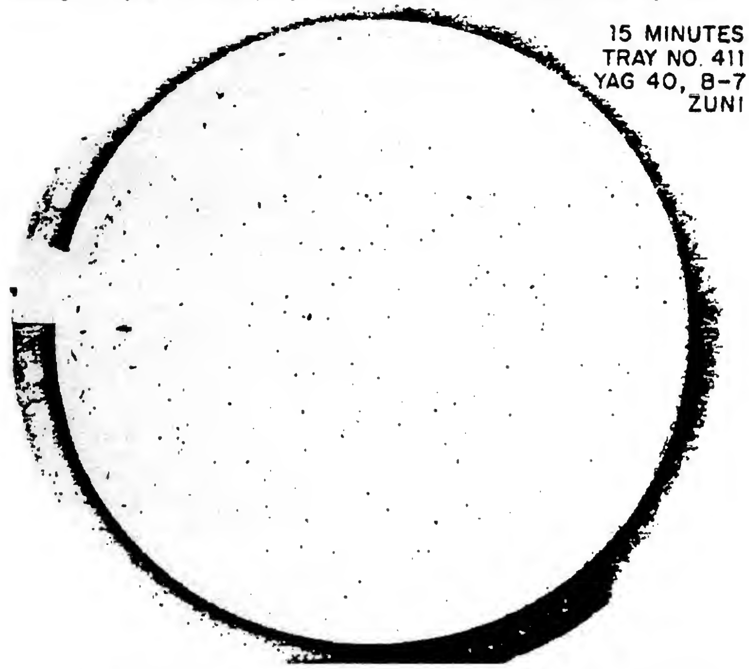
Right: photograph from D. H. Peirson, et al, report AWRE-T28/57, 1957, p. 26. Crown Copyright Reserved.



Above: fallout creation at 1, 8, and 20 seconds after detonation of the Australian-British 15 kt burst on a tower 30.5 m high, *Buffalo – One Tree,* at Maralinga, 27 September 1956. The turbulent mixing of sand and gas in the vortex fireball are clearly visible in the dry atmosphere, forming the mixture of fallout particles seen in the photograph above. The background grid of smoke trails seen at 1 second was laid down well behind the fireball by rockets fired about 8 seconds before detonation, specifically to make the shock front visible in films. The shock makes smoke trails appear to 'break' (just an illusion caused by the optical refraction of light in the compressed air of the shock front).

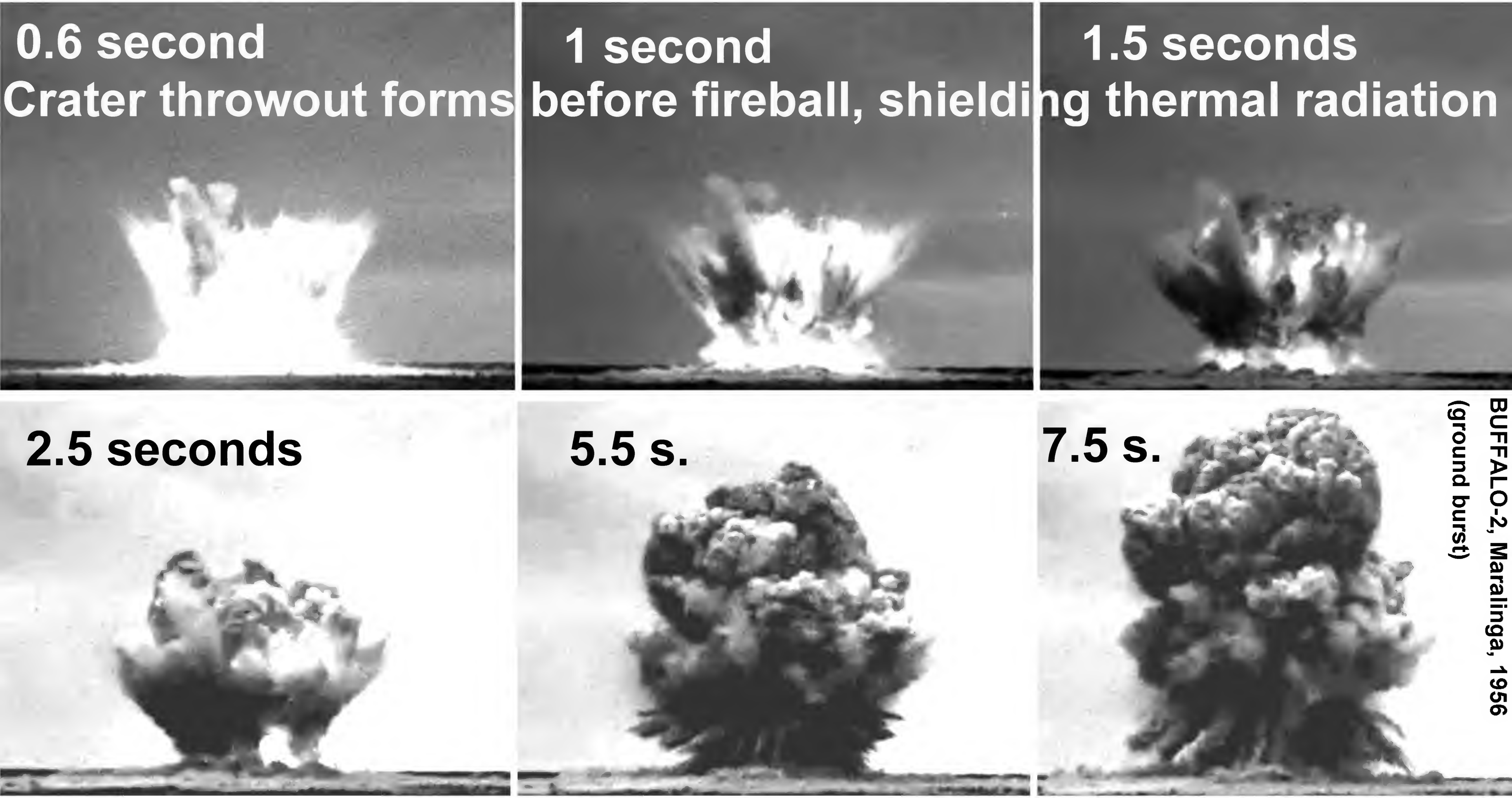


Below and left: *T. Triffet & P. D. LaRiviere, 'Characterization of Fallout,' U.S. Naval Radiological Defense Laboratory, report WT-1317, 1961, Secret-Restricted Data, p. 144.*

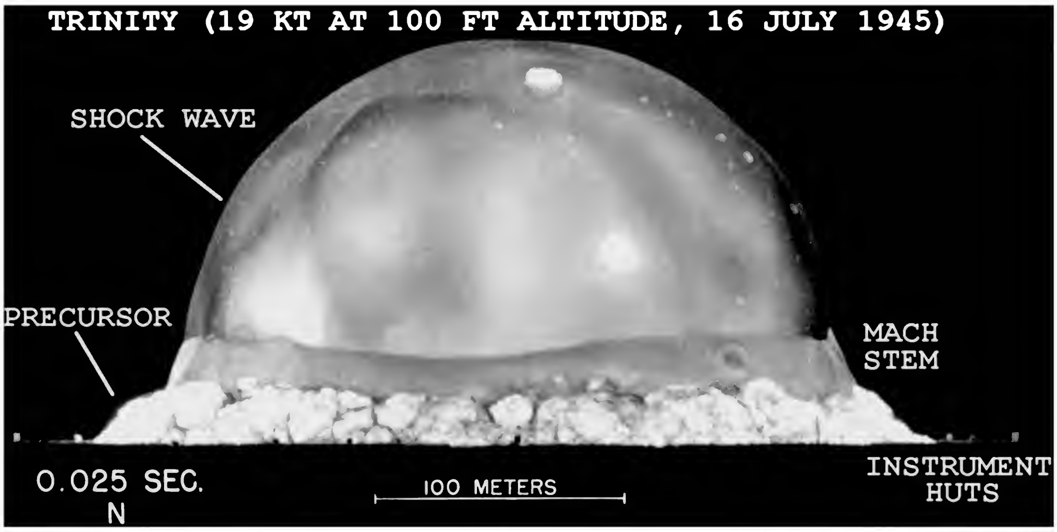


Seen and felt: 1956 secret photo of a fallout tray automatically exposed for just 15 minutes at 1 hour after detonation of the 3.53 Mt surface burst *Zuni*. Fallout on barge YFNB 13, at 20 km North-North-West of ground zero (downwind). The tray's inner diameter is 8.1 cm. This sample is only 22% of the total deposit of 21.9 g/m^2 at that location. The barge's radiation meter recorded a peak gamma intensity of 6 R/hr at 1.25 hours.

Seen and felt: 1956 secret photo of a fallout tray automatically exposed for just 15 minutes at 6 hours after detonation of the 3.53 Mt surface burst *Zuni.* Fallout on ship YAG 40, at 97 km North of ground zero (downwind). The tray's inner diameter is 8.1 cm. This sample is only 12% of the total deposit of 14.1 g/m^2 at that location. The ship's radiation meter recorded a peak gamma intensity of 7.6 R/hr at 6.7 hours.



Afterwinds immediately suck in base surge dust from throwout


TRINITY (19 KT AT 100 FT ALTITUDE, 16 JULY 1945)
SHOCK WAVE
PRECURSOR
MACH STEM
0.025 SEC.
N
100 METERS
INSTRUMENT HUTS


PRECURSOR DUST CLOUD ABSORBS FIREBALL BASE HEAT FLASH
1.0 SEC.
N
100 METERS


TOWER BASE, 1.4 R/HOUR
11 SEPTEMBER 1945

BROOKHAVEN NATIONAL LABORATORY BNL 917 (C-43)

ECOLOGICAL EFFECTS OF NUCLEAR WAR

*Proceedings of a Symposium**
Sponsored by

THE ECOLOGICAL SOCIETY OF AMERICA

at the
Thirteenth Meeting of

THE AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES

Amherst, Massachusetts

August 1963

Physical Damage From Nuclear Explosions

CARL F. MILLER
Stanford Research Institute, Menlo Park, California

(pages 1-10)

Table 2

Survival Rates at Hiroshima and Nagasaki

Exposure	Condition	% Survival
50-100 cal/cm^2	Outside	0
	Indoors or shielded	90-100
4-6 psi	Outside	0
	In frame building	85-90
	In concrete building	95-100
	In underground shelter	100

The large particles contributing to local fallout consist mainly of fused and sintered grains of soil minerals. Fused particles are spherical, glassy beads and are usually the most highly radioactive. While in a fluid state in the fireball, these particles incorporate a large fraction of the least volatile fission products into a glassy matrix where such fission products are fixed. As the particles cool in the fireball and become viscous, the more volatile fission products (or their daughter products) collect on their surfaces. In this way, the larger of the fallout particles, those first ejected from the fireball, have radionuclide compositions enriched with the least volatile fission products, i.e., volatile element concentration is lowest. The smaller fallout particles, which remain in the rising cloud the longest, have radionuclide compositions enriched in the volatile elements.

Table 3

Contamination Factor, a_L,* for Crops

Romney, E.M., Lindberg, R.G., Hawthorne, H.A., Bystrom, B.G., and Larson, K.H. 1963. Contamination of plant foliage with radioactive fallout. *Ecology* **44**, 343-9.

Distance from ground zero, miles	Red clover	Alfalfa	Wheat	Mixed grasses
		Apple II Shot (Tower)		
7	5.6×10^{-5} (0.0011)**	–	5.3×10^{-5} (0.0020)	–
48	4.2×10^{-4} (0.0066)	–	6.0×10^{-4} (0.0240)	–
106	8.3×10^{-4} (0.0120)	–	18.0×10^{-4} (0.0580)	–
		Smoky Shot (Tower)		
132	–	2.6×10^{-3} (0.0490)	–	–
259	–	4.2×10^{-3} (0.1170)	–	3.2×10^{-3} (0.0530)

$$*a_L=\frac{\text{gross activity collected per g dry weight of foliage}}{\text{gross activity collected per sq ft of soil area}}=\frac{\text{sq ft of soil area}}{\text{g dry foliage}}.$$

**Values in parentheses are the fractions retained; they are equal to $a_L w_L$ where w_L is the foliage surface density in grams of dry foliage per sq ft of soil area.

Table 4

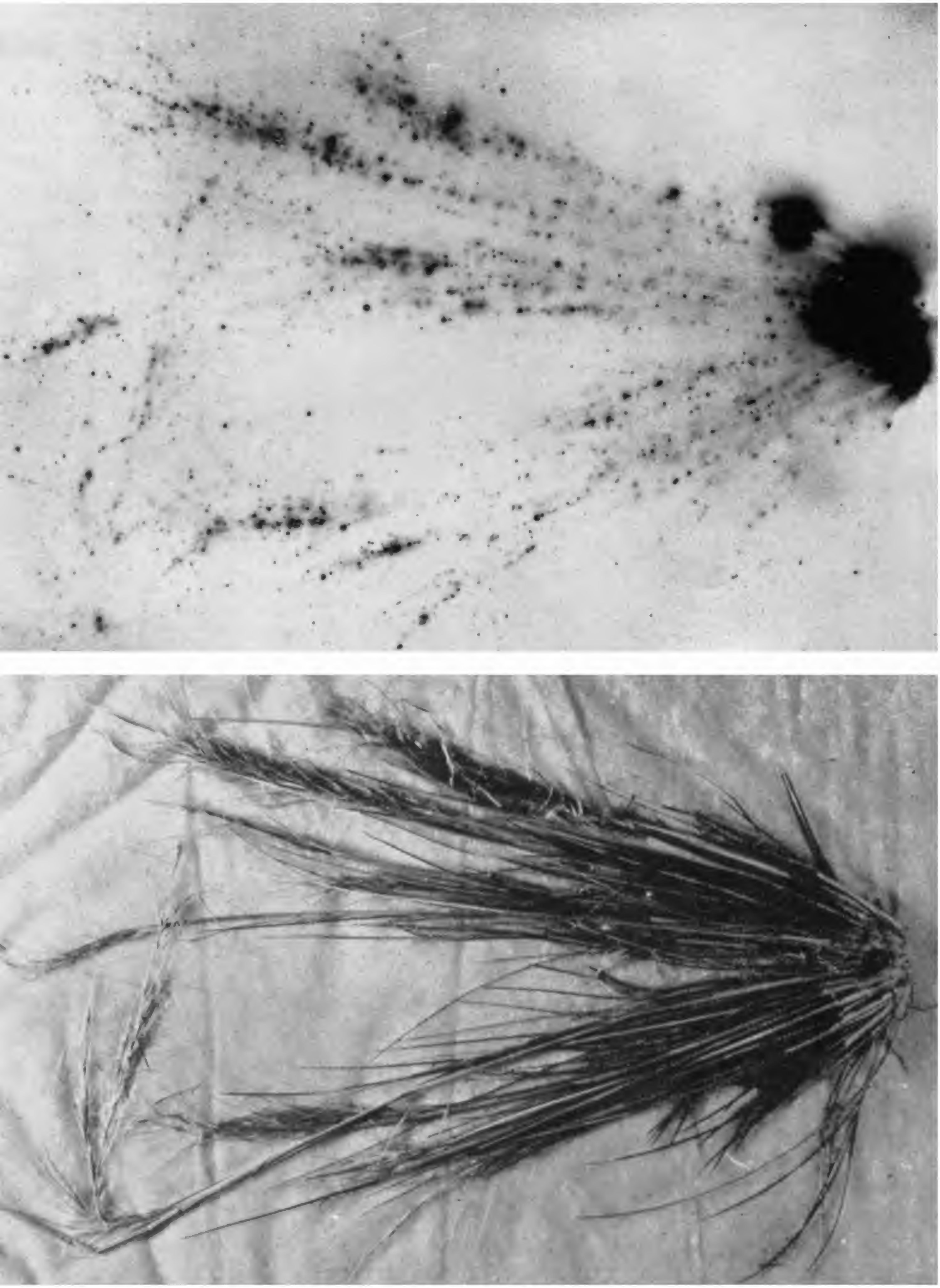
Russell, R.S. and Possingham, J.V. 1961. Physical characteristics of fallout and its retention on herbage. In *Progress in Nuclear Energy*. Series VI, Biological Sciences, Vol. 3, J.C. Bugher et al., Editors. Pergamon Press, New York. Pp. 2-26. **(AWRE-T-57/58, May 1959.)**

Summary of a_L Values Obtained at Operation Buffalo for Contamination of Rye Grass

Approximate I(max) range, r/h at 1 hr	$a_L(\text{av}), \frac{\text{sq ft of soil area}}{\text{g foliage}}$	$a_L w_L$*
0.07–0.15	6.8	0.15
0.15–0.30	7.1	0.16
0.30–0.60	5.9	0.13
0.60–1.00	2.7	0.06
1.00–2.00	4.0	0.09
2.00–5.00	2.9	0.07
5.00–9.00	1.4	0.03

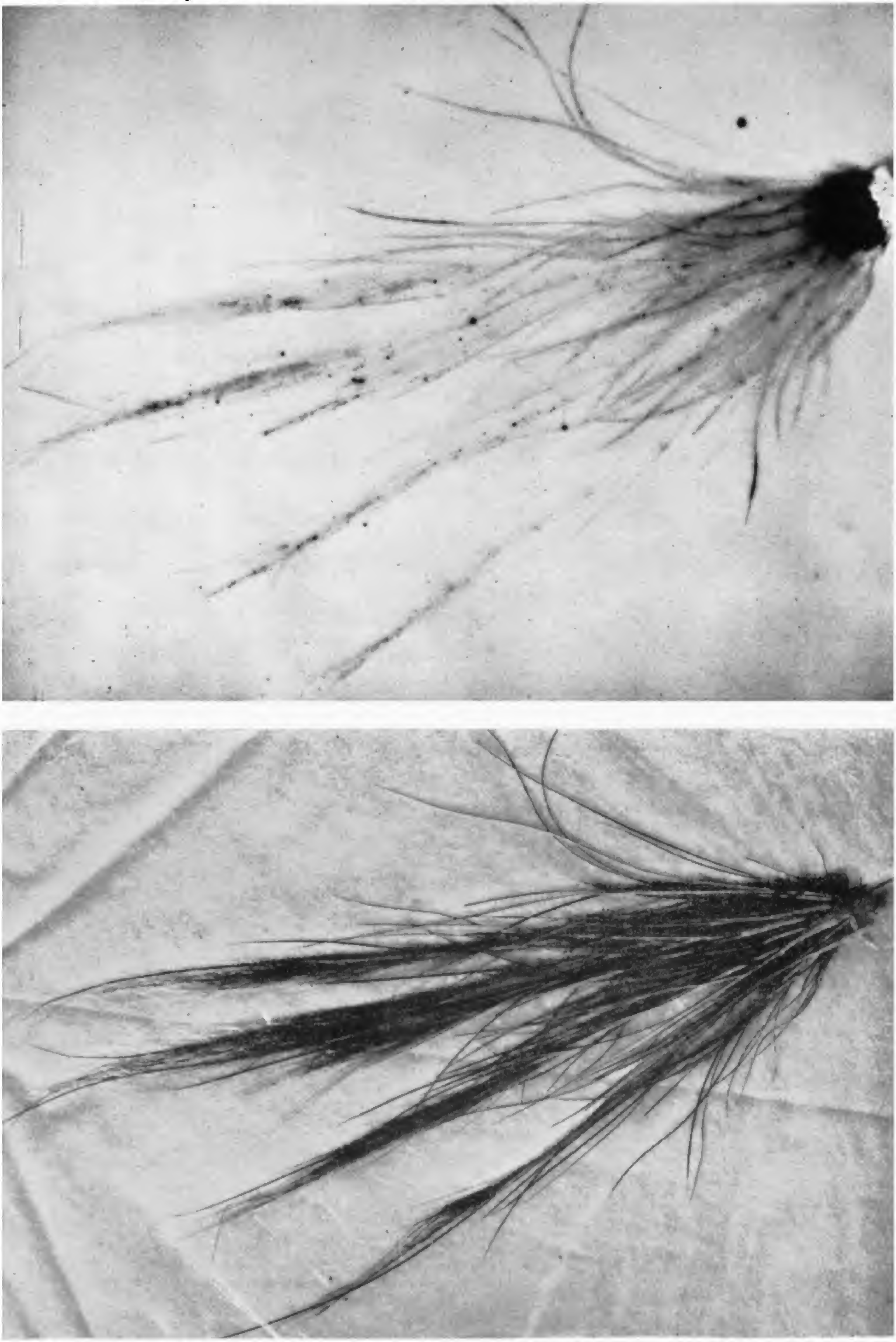
*Where $w_L = 22.3$ g foliage/sq ft of soil area (height of grass $= 0.33$ ft).

Ryegrass (Lolium perenne) after 15 kt Buffalo-1 tower shot at Maralinga



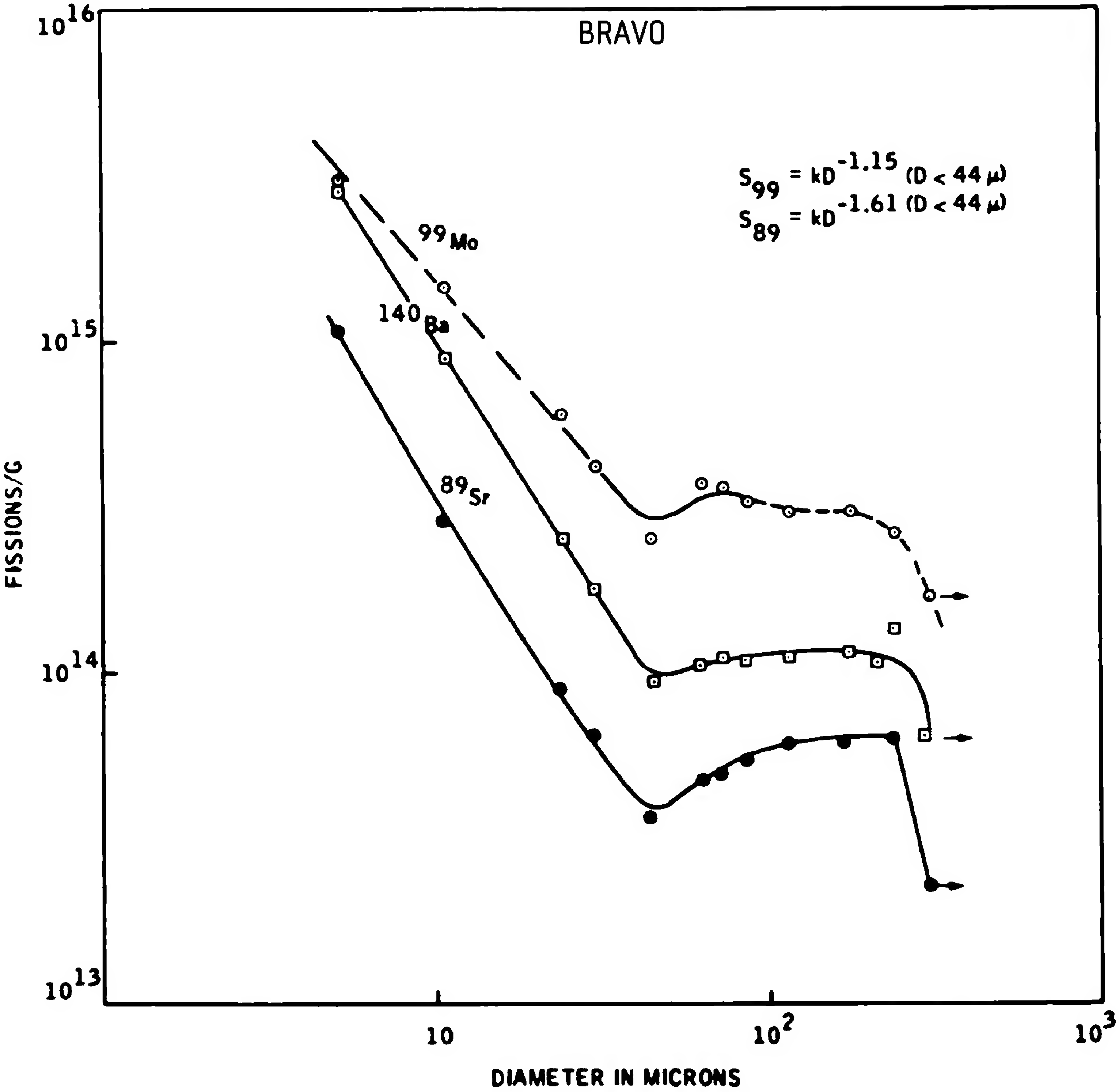
Little dry surface burst silicate fallout is retained

AWRE-T-57/58, May 1959



Ryegrass (Lolium perenne) after 1.5 kt Buffalo-2 surface shot at Maralinga, after 2 cm rain

Morgenthau, M., H. E. Show, R. C. Tompkins, and P. W. Krey. 1960. Land fallout studies. Defense Atomic Support Agency Rep. WT-1319. Washington, D.C.



Specific activity of fallout as function of particle diameter

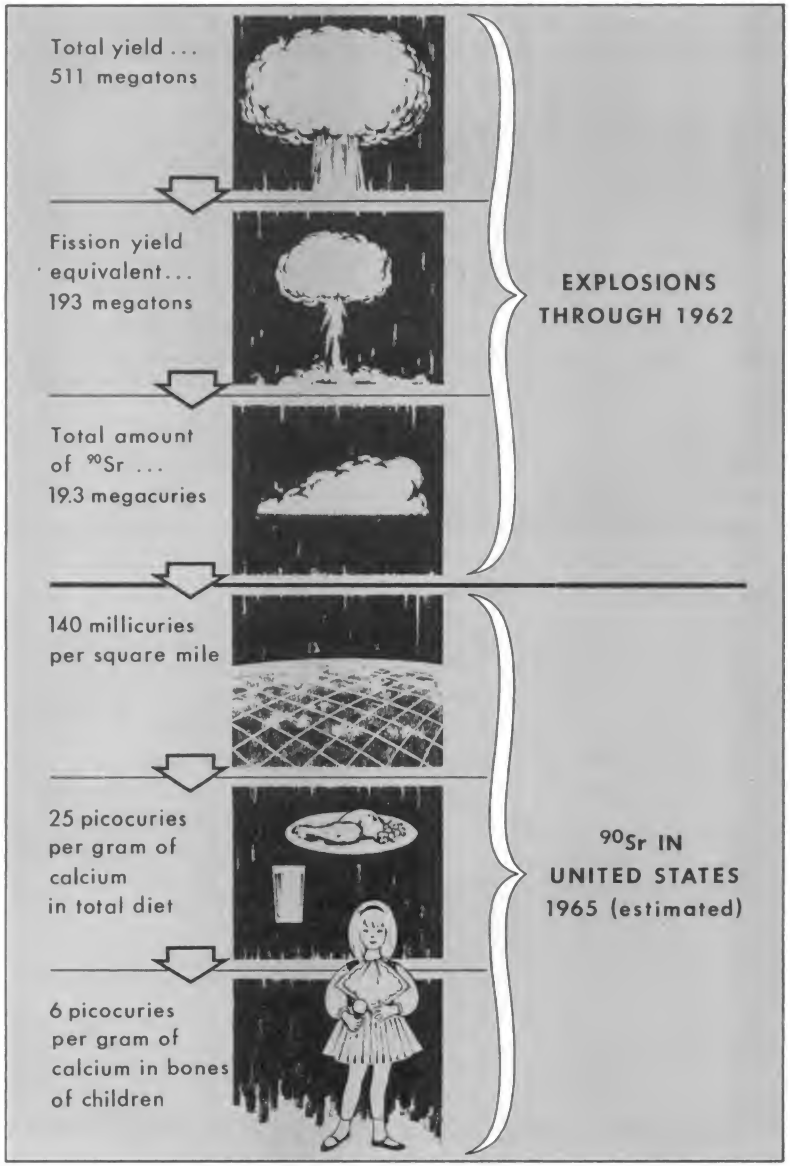
(Equivalent fissions $\times 10^{-14}$ per gram)

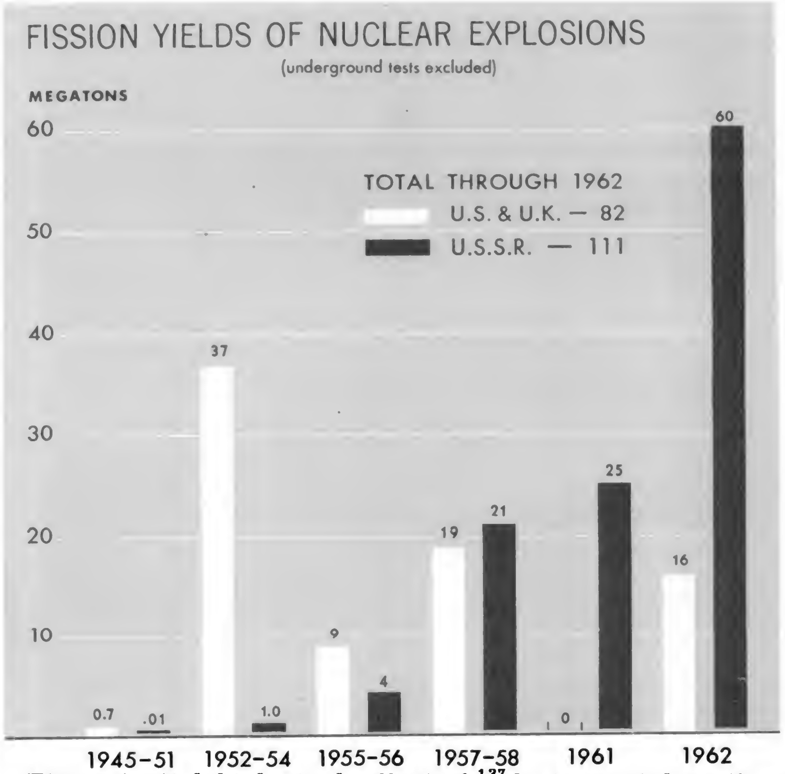
$D_g(\mu)$	ZUNI 3.5 Mt (Prompt Fallout near Ground Zero)	ZUNI 3.5 Mt (Fallout Collected 80 km Downwind)	TEWA near ground zero 5.1 Mt	15 Mt BRAVO (Radioactive Particles Only, Shot Atoll, Spheres plus Irregulars)	LACROSSE 0.04 Mt (All Particles, Shot Atoll, Spheres plus Irregulars)
Chain 99 (^{99}Mo)					
57	4.8	16.0	10.2	7.2	2.5
88	4.9	10.6	8.9	6.6	4.0
125	5.8	9.8	8.4	6.2	4.7
177	6.0	12.5		6.0	5.7
297	12.4	13.2		4.8	4.5
594	11.9	21.3		3.4	1.6
840	3.1	24.3		–	–
Chain 89 (^{89}Sr)					
57	0.075	0.24	0.36	0.086	0.063
88	0.065	0.17	0.28	0.11	0.074
125	0.046	0.19	0.24	0.12	0.082
177	0.042	0.14		0.12	0.062
297	0.043	0.12		0.13	0.044
594	0.044	0.11		0.046	0.063
840	0.075	0.070		–	–
Chain 140 (^{140}Ba)					
57	0.32	1.28	0.67	0.20	0.25
88	0.27	0.74	0.54	0.22	0.28
125	0.20	0.99	0.45	0.22	0.30
177	0.17	0.77		0.23	0.23
297	0.15	0.75		0.25	0.18
594	0.16	0.67		0.13	0.24
840	0.031	0.41		–	–

Morgenthau, M., H. E. Show, R. C. Tompkins, and P. W. Krey. 1960. Land fallout studies. Defense Atomic Support Agency Rep. WT-1319. Washington, D.C.

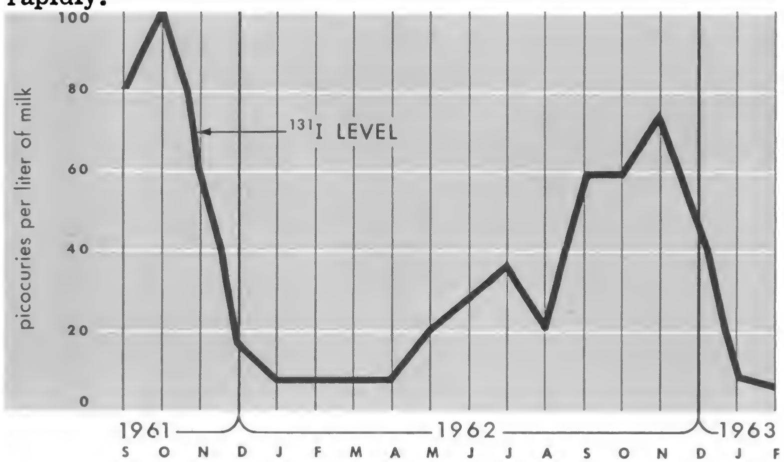
Fall out from nuclear tests, by C. L. Comar (U.S. Atomic Energy Commission, Understanding the Atom series, revised edition, 1966)

PAST EXPLOSIONS AND STRONTIUM-90 LEVELS





The potential biological effect of ^{137}Cs is much less than that of ^{90}Sr because ^{137}Cs is removed from the body more rapidly.



Remedial measures for ^{131}I are relatively simple because of its short half-life, and because it reaches the public primarily in a single identifiable food, milk.

Measures proposed to be put into effect should ^{131}I in milk reach stipulated levels are:

(a) *Use of stored feed instead of pasture for dairy cows.*

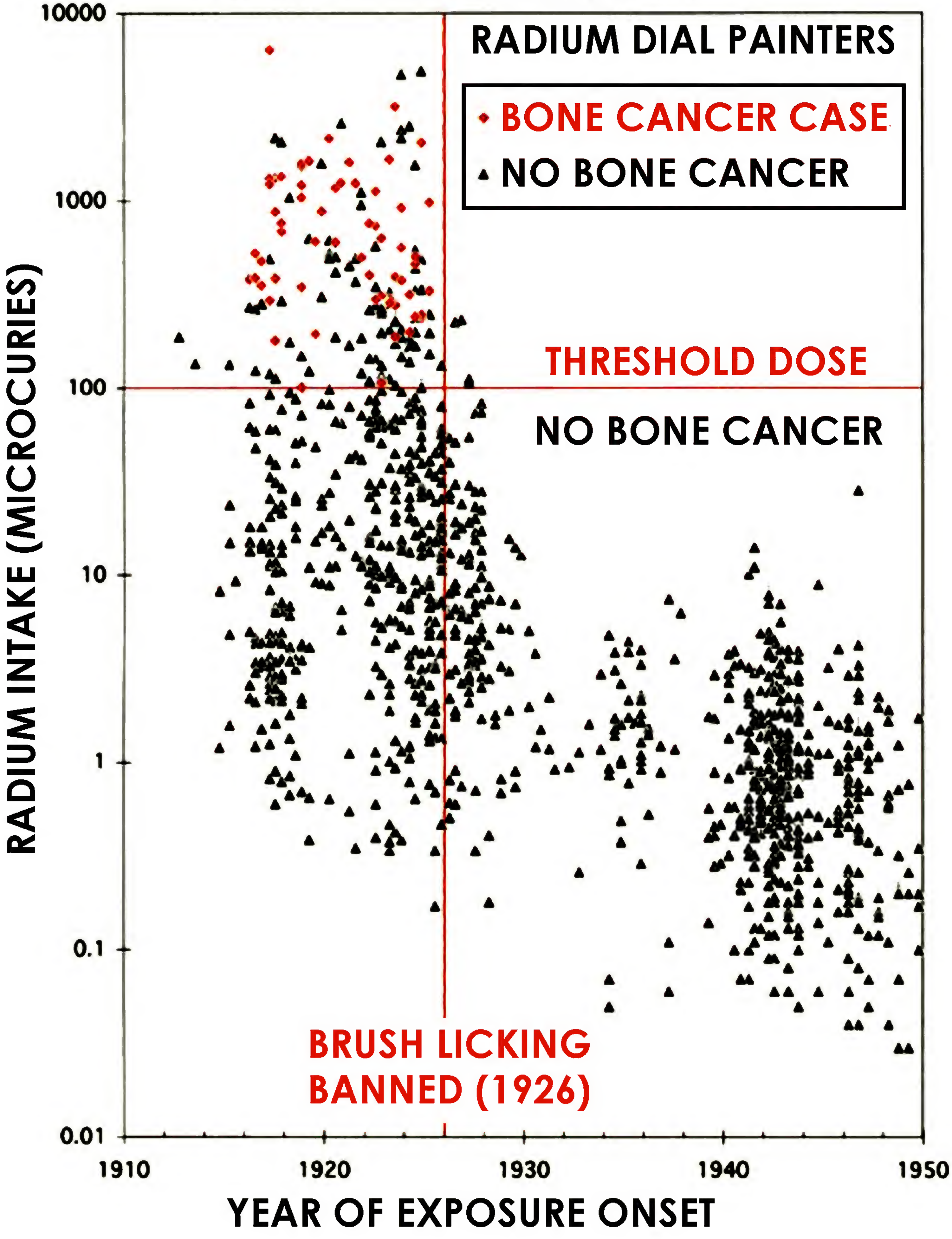
(b) *Use of evaporated or powdered milk for young children and pregnant and lactating women.*

(c) *Use of stored milk products.*

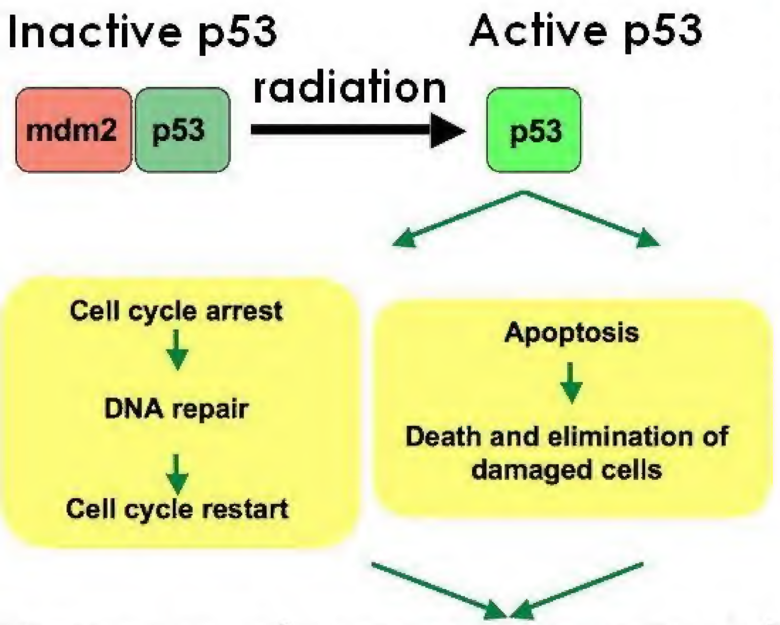
Addition of stable iodine to human diet.

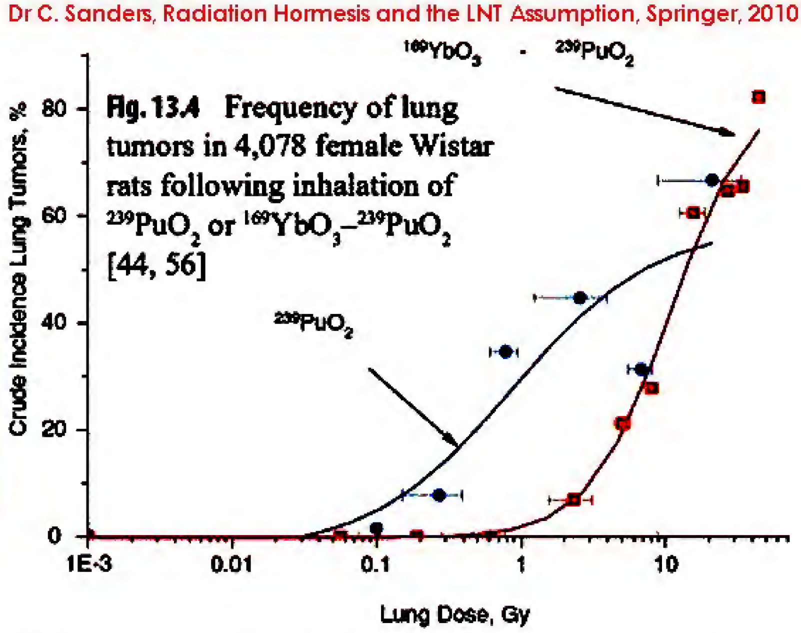
Cyril L. Comar is professor of physical biology at Cornell University and has acted as consultant and advisor to many national and international committees

Rowland, R. E. Radium in Humans: A Review of U. S. Studies, Argonne National Laboratory (1994).



Dr C. Sanders, Radiation Hormesis and the LNT Assumption, Springer, 2010

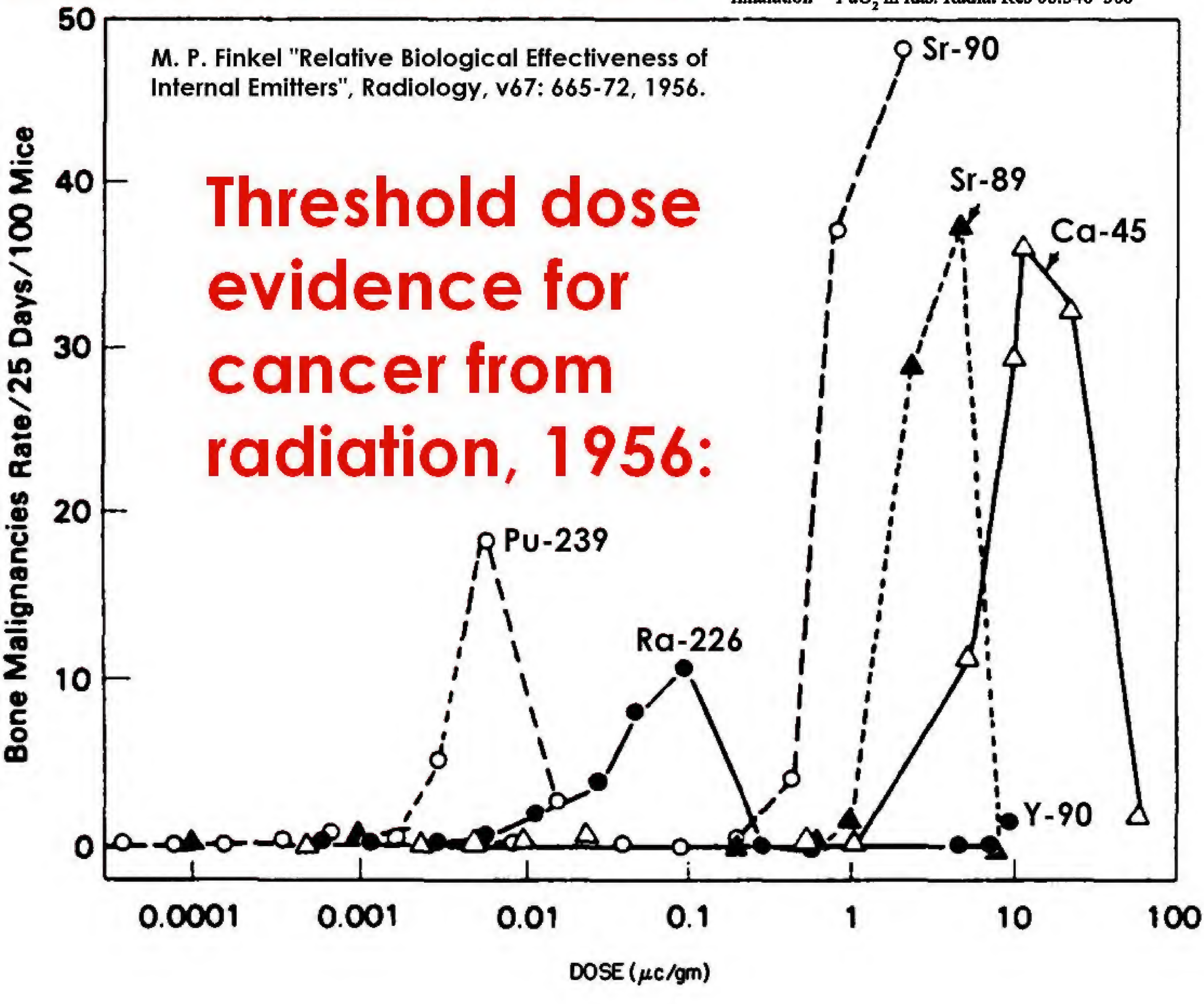




Prevention of cancer or genetic defect at low dose rates (at high dose rates, double strand DNA breaks are too rapid)

44. Sanders CL, Lauhala KE, McDonald KE (1993) Lifespan studies in rats exposed to $^{239}PuO_2$ aerosol. III. Survival and lung tumors. Int J Radiat Biol 64:417–340

56. Sanders CL, Dagle GE, Cannon WC et al (1976) Inhalation $^{239}PuO_2$ in rats. Radiat Res 68:340–360



Dose range milli-sievert	Number in 1950	Cancer deaths (excl. leukaemia)		Leukaemia deaths	
		total rate	rate from radiation	total rate	rate from radiation
Less than 100	68467	11.2%	0.09%	0.2%	0.01%
100 to 200	5949	12.3%	0.7%	0.2%	-0.01%
200 to 1000	9806	13.2%	1.9%	0.6%	0.3%
More than 1000	1829	24.1%	8.1%	3.5%	2.4%
All	**86611**	**11.7%**	**0.6%**	**0.3%**	**0.1%**

Cancer deaths among 86611 Hiroshima and Nagasaki survivors, 1950-2000
The total radiation-related deaths from solid cancer and leukaemia were 480 and 93, respectively.

http://www.bioone.org/doi/abs/10.1667/RR3232

Preston, D. L., Pierce, D. A., Shimizu, Y., Cullings, H. M., Fujita, S., Funamoto, S. and Kodama, K., "Effect of Recent Changes in Atomic Bomb Survivor Dosimetry on Cancer Mortality Risk Estimates," Radiat. Res. v162, pp377–389 (2004).

Source: Dr Wade Allison
1 milliSievert = 100 mR

1979 U.S. Office of Technology Assessment, "The Effects of Nuclear War" deceptions

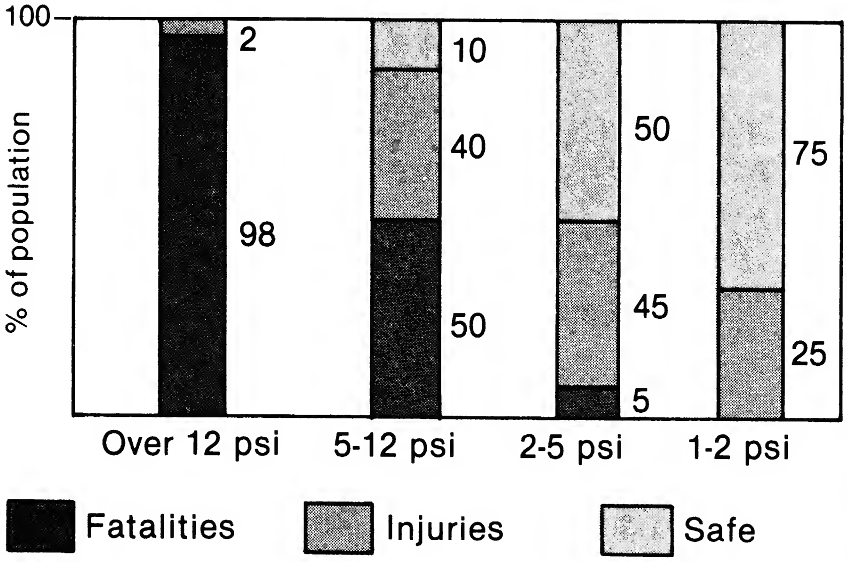
Table 14.—Long-Term Radiation Effects From Nuclear Attacks

Estimated worldwide[b] effects from 1-Mt air burst over a city (OTA Case 1):	
Somatic effects	
Cancer deaths	200 - 2,000
Thyroid cancers	about 700
Thyroid nodules	about 1,000
Genetic effects	
Abortions due to chromosomal damage	100 - 1,000
Other genetic effects	350 - 3,500

[b] Most worldwide fallout would be in the Northern Hemisphere

Above: false LNT radiation scaremongering

Figure 1.—Vulnerability of Population in Various Overpressure Zones



Damage to unreinforced brick house (5-psi overpressure)

Above: false house collapse (Apple-2 test house after manually demolished!) photo. In fact, outer walls exploded but 1st floor did not collapse at 5 psi, and outward debris motion reduced hazard!

Blast exaggeration:

Table 4.—Casualty Estimates (in thousands) (1 Mt on Detroit)

Region (mi)	Area (mi²)	Population	Fatalities	Injuries	Uninjured
0-1.7	9.1	70	70	0	0
1.7-2.7	13.8	250	130	100	20
2.7-4.7	46.5	400	20	180	200
4.7-7.4	102.6	600	0	150	450

Exaggerated blast effects table ignores modern city concrete buildings which resist blast collapse

Table 5.—Burn Casualty Estimates (1 Mt on Detroit)

Distance from blast (mi)	Survivors of blast effects	Fatalities (eventual)		Injuries	
		2-mile visibility	10-mile visibility	2-mile visibility	10-mile visibility
(1 percent of population exposed to line of sight from fireball)					
0-1.7	0	0	0	0	0
1.7-2.7	120,000	1,200	1,200	0	0
2.7-4.7	380,000	0	3,800	500	0
4.7-7.4	600,000	0	2,600	0	3,000
Total (rounded)		1,000	8,000	500	3,000
(25 percent of population exposed to line of sight from fireball)					
0-1.7	0	0	0	0	0
1.7-2.7	120,000	30,000	30,000	0	0
2.7-4.7	380,000	0	95,000	11,000	0
4.7-7.4	600,000	0	66,000	0	75,000
Total (rounded)		30,000	190,000	11,000	75,000

These calculations arbitrarily assume that exposure to more than 6.7 cal/cm² produces eventual death, and exposure to more than 3.4 cal/cm² produces a significant injury, requiring specialized medical treatment.

Exaggerated thermal burns table "arbitrarily" assumes 6.7 cal/cm^2 is lethal and 3.4 cal/cm^2 hospitalizes.

This was not true even for light clothing in Hiroshima and for bigger yields even more heat is needed! Skyline shadowing protects over 90%.

29 kt Teapot-Apple 2 test, 5 psi peak overpressure

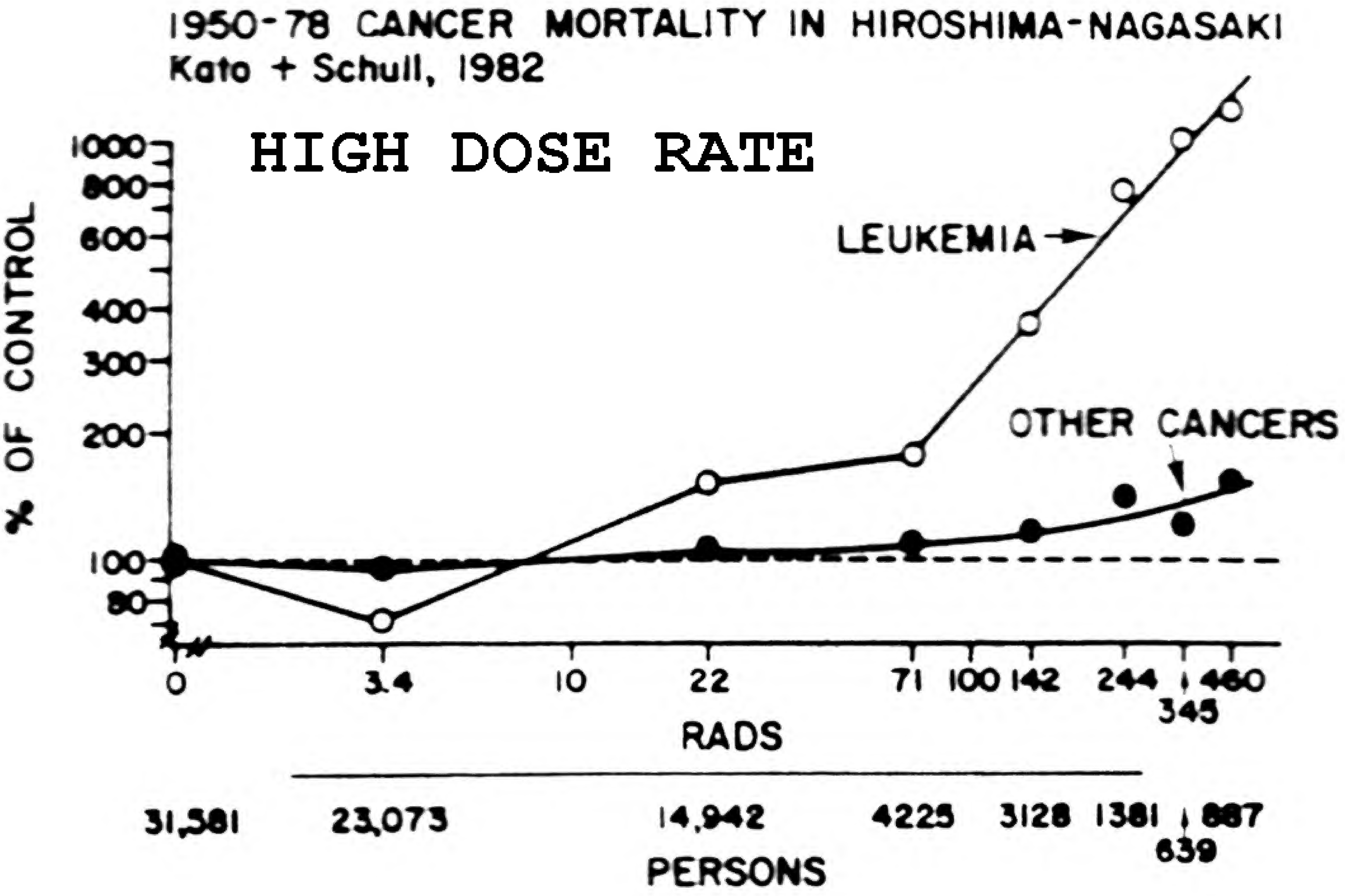
exterior walls were exploded outward, so that very little masonry debris fell on the floor framing. The roof was demolished and blown off, the rear part landing 50 feet behind the house.

S. Glasstone, Effects of Nuclear Weapons, 1964, p208
Wall brick debris was blown out, not in on to people!





Morrison shelter survives direct hit in York 1942


1950-78 CANCER MORTALITY IN HIROSHIMA-NAGASAKI
Kato + Schull, 1982
HIGH DOSE RATE
% OF CONTROL
1000
800
600
400
300
200
100
80
LEUKEMIA
OTHER CANCERS
0
3.4
10
22
71
100
142
244
345
460
RADS
31,581
23,073
14,942
4225
3128
1381
639
887
PERSONS

HOME OFFICE

CIVIL DEFENCE
TRAINING MEMORANDUM No. 4

The Clearance of Z Zones by Road

(*REVISED* 1965)

(Z Zones are fallout areas where the 48 hour gamma dose rate is above 10 R/hour. This corresponds to a dose rate of 1,000 R/hour or more at 1 hour after a nuclear explosion. The outside dose accumulated from an arrival time of 1 hour after a 1 megaton burst, up to evacuation at 48 hours, is:

$$\text{Dose} = 5 \times 1000 \times (1 - 48^{-0.2}) = 2{,}700 \text{ R outdoors}$$

or 67 R in a brick house's room with blocked windows)

LONDON
HER MAJESTY'S STATIONERY OFFICE
1965

SIXPENCE NET

The Clearance of Z Zones by Road

Introduction

1 This memorandum is concerned with the drill for clearance by road from those parts of a Z Zone which are not in a damaged area. In a damaged area the drill would have to be modified as necessary to meet the special conditions obtaining, e.g. restriction of road access. The memorandum deals only incidentally with the areas to which people will be cleared. It is assumed that 'assembly towns' of, say, from 8,000 to 50,000 population at distances up to about 20 miles from the Z Zone will be selected to receive those cleared; and that the bases from which clearance operations will be mounted will be on the outskirts of those assembly towns commanding main routes into the Z Zone. It may sometimes be desirable to site the clearance bases further forward; in which case staging points will be set up from which people will be transported to the assembly town by train or other means.

2 In clearance the maximum use must be made of all forms of petrol-driven transport, including public transport already within a Z Zone. Families capable of clearing themselves should do so; and wardens should, so far as possible, arrange in advance that spare places are reserved for neighbours. The opportunity should be taken wherever possible to provide for people living in remote areas without their own transport to be collected by private transport on the way out. This will simplify the task of clearance from outside. Instructions to the public will require that houses left completely empty should be marked by the last person to leave by hanging a sheet out of a front window.

3 The proportion of population capable of being moved by transport already in a Z Zone is likely to be substantial but the remainder will have to be cleared by transport sent in from outside.

4 The closest contact will have to be maintained at every level between the warden organisation within the Zone and the clearance forces working from outside. The wardens will be responsible for providing clearance forces with essential information; and, in anticipation of the area coming within a Z Zone, should make the preliminary plans described in Appendix I.

General principles of clearance

5 The physical clearance of a Z Zone would rarely start before H+48 hours although planning might be instituted at an earlier time. The wartime emergency dose of 75r will apply to all engaged. The object will be to clear the Zone as quickly as possible within the limits set by this dose and the size of the forces available.

6 Clearance by night or when visibility is bad, is likely to increase the time of exposure and should be avoided if possible. Delays caused by suspending clearance during the hours of darkness would make little difference to the total dose received by those in their fallout rooms in the Z Zone.

7 For clearance from outside, passenger carrying vehicles with a capacity of not less than 30 should be used. The use of vehicles of lesser capacity would be radiologically extravagant to clearance personnel, and should not be used unless there is no practical alternative.

8 Zones will be cleared inwards sector by sector or district by district. Throughout each sector or county district* council areas in turn self-clearance will be effected first and clearance organised from the outside will then be undertaken as far as possible simultaneously in every warden post and patrol area.

9 Clearance vehicles will operate in convoys of about five. In general one convoy will be allotted to each patrol area. To avoid unnecessary exposure to radiation of their occupants, vehicles should be sent individually to assembly towns as soon as they are loaded unless there is some good reason for acting otherwise. After unloading they will be reformed into convoys at the clearance base.

10 In built-up areas convoys will on their initial trip be directed to the warden posts and from there to the patrol areas they are to clear. In rural areas this method of routing would be radiologically expensive and should be unnecessary. Where the position of a patrol post can be easily indicated on a 1" map the rule will be for the convoy to go direct to the patrol post in rural areas.

Allotment of responsibilities

11 Overall responsibility for deciding when a Z Zone is to be cleared and where the population of the Zone is to be moved will rest with the Regional Seat of Government which will allot responsibilities to individual Sub-regional headquarters. Responsibility for clearing segments of a Z Zone, and the transport for that purpose will be alloted by Sub-regional headquarters to county or county borough controls. Responsibility for receiving the people cleared will be apportioned to the county or county borough controls within whose boundaries the assembly towns lie. Where responsibilities are separated co-ordination will be maintained by the next higher control, e.g. co-ordination between county or county borough controls by Sub-regional headquarters.

12 A single Z Zone may well extend into two or more Regions and a single Region contain parts of two or more separate Zones. Each Zone will have been given a code name. For clearance purposes segments will be known as Regional, Sub-regional, county, and in some cases county sub, or county borough segments as the case may be, and will be further identified by the appropriate numbers and letters of the responsible control, e.g. county segment (or simply segment) 62A.

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* NOTE: All later references to 'district' refer to 'county district council areas'.

13 Operations will be conducted by clearance units, set up by the responsible control, which will appoint the commanders, establish the bases and give each unit a segment, to be known as a clearance segment, to deal with. The boundaries of clearance segments should so far as is possible follow those of warden sectors or districts if sectors do not exist. Clearance unit comanders will normally be civil defence assistant controllers (Ops) or mobile controllers, unless the unit is provided by the military or by a police mobile column. Within a county or county borough all units, under whatever command, will be lettered in sequence and the same lettering will be used to identify the clearance segments, e.g. (clearance) segment 62AA.

14 A clearance unit should have about 125 buses or coaches, with an average lifting capacity of, say, 5,000 people. One hundred and fifty vehicles (average lifting capacity 6,000) should be regarded as the maximum. The number of lifts that can be accomplished in a day will depend on the time of year, whether the population of the segment is concentrated or scattered, and the length of run to the assembly town or staging point; but it may be expected to vary from about two to four. County or county borough control must judge from these factors the number of units required and the size of the clearance segments to be allotted to each. During the progress of operations there may well be need to adjust either the boundaries of the segments or the strength of the units.

15 It may be necessary for a clearance unit to call in the ambulance resources of counties or county boroughs in order to clear people whose physical condition makes it impossible to transport them by bus or coach. For radiological reasons the use of ambulances must be kept to an absolute minimum. If there should be an acute hospital, containing a large number of patients, in the Z Zone, special arrangements for their clearance and reception would have to be made at county or county borough level or above.

The clearance unit

16 In order that a clearance unit, when clearing each sector or district in its turn, should be able to work simultaneously in every warden post and patrol area within that sector or district it should have an operational staff approximating to the following "standard".

Clearance unit commander (1): to be responsible for organising the clearance of the sector or district generally.

Clearance officers (5): each responsible for organising the clearance of a warden post area and taking charge of a section of five convoys.

Convoy commanders (25): each in charge of a convoy of five buses or coaches operating in a given patrol area.

Drivers and mates will be needed for the 125 buses and/or coaches and drivers for the six cars with which the unit will be provided. Relief bus drivers should be sought as required, if necessary with the help of local Ministry of Labour representatives.

Signal staff and equipment for maintaining communications with the static control, should telephones not be working, and office staff for a mobile control plus six messengers, would also be required.

17 Of the above, the convoy commanders, bus drivers and mates whose duties will take them constantly in and out of the Z Zone, will have to be replaced as and when their wartime emergency doses are expended—perhaps after seven or eight lifts over two or four days. Clearance officers and car drivers and messengers will also enter the Z Zone, but less frequently and for shorter periods; so that in their case replacement should not be necessary for a long time, if at all.
(For administrative staff at base see paragraph 22).

18 This "standard" unit may be varied as required by increasing or reducing the number of buses or coaches and so the size or number of convoys or convoy sections with consequent alterations in the number of convoy commanders or clearance officers. Considerations of administration and maintenance will, however, require an upper limit of 150 vehicles.

19 Whatever unit is employed there will almost certainly be need to make constant readjustment between the various parts during the course of operations; according, for instance, to the number of warden post and patrol areas within whichever sector is being cleared, their populations, and the particular difficulties they present.

20 The designations used in paragraph 13 are entirely functional. Except where a clearance unit is provided by a military formation or a police mobile column its operational staff may be drawn from a variety of sources. (See Appendix III.) It is of great importance that the right people should be found to act as convoy commanders, since these will have the major responsibility for dealing with the public in the Z Zone, and (as will be evident from paragraph 32) the task is one requiring an ability to inspire confidence and the highest qualities of firmness and tact. The work might be undertaken by post or deputy post wardens from areas unaffected by fallout; but it is one for which police officers would be particularly well suited.

The clearance base

21 The essential facilities required for a clearance base are:

(a) Good communications.

(b) Access to adequate P.O.L. supplies.

(c) Hardstanding for the vehicles.

(d) Accommodation for personnel.

(e) Feeding facilities (these might be provided in billets or by Welfare Section emergency feeding teams).

It should be possible for the facilities to be found on the outskirts of most towns. A large bus depot would be ideal.

HOME OFFICE

CIVIL DEFENCE
TRAINING MEMORANDUM No. 6

The Evacuation of Casualties

(*PROVISIONAL*)

LONDON
HER MAJESTY'S STATIONERY OFFICE
1961

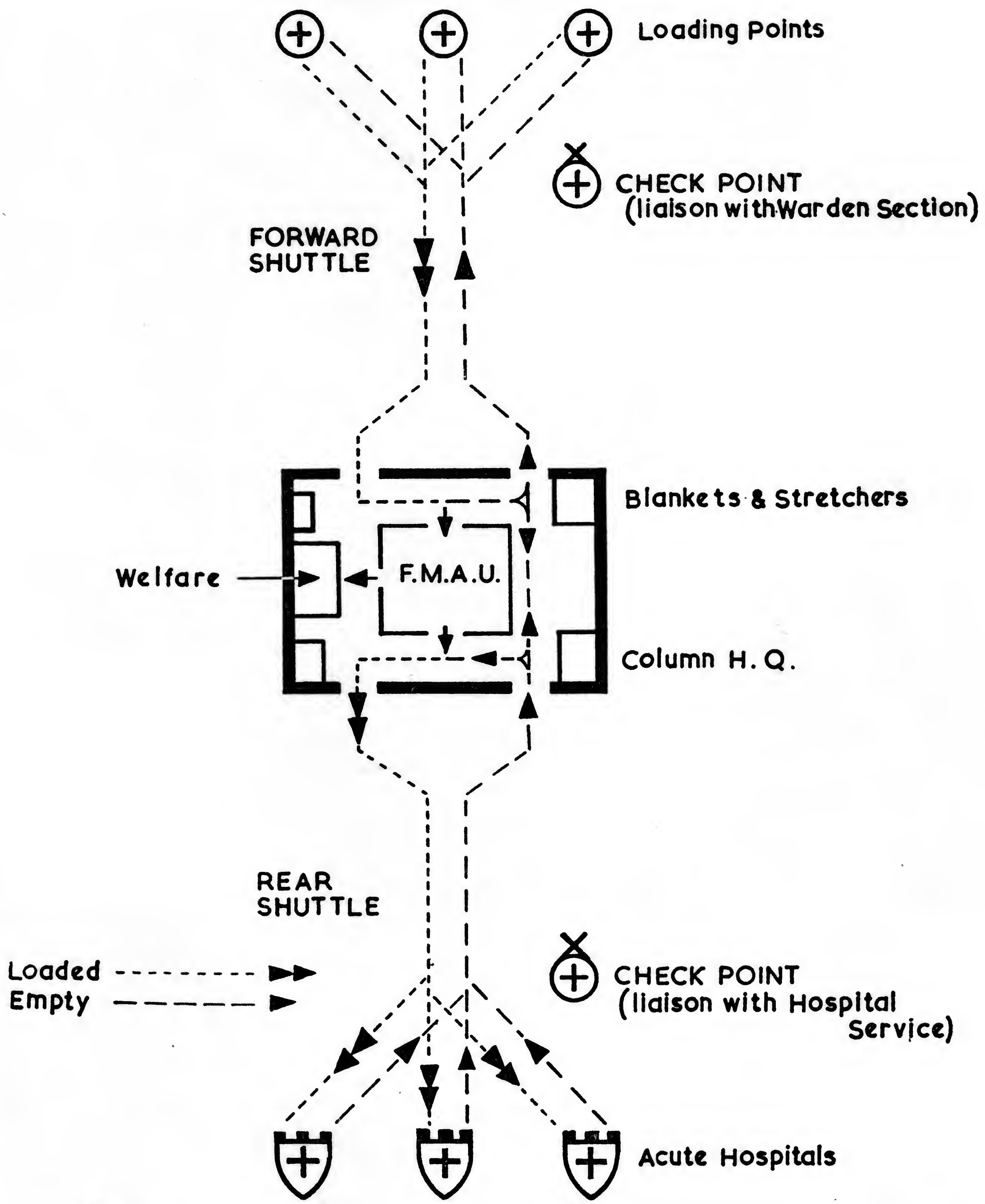
EIGHTPENCE NET

THE ORGANISATION OF AN AMBULANCE COLUMN

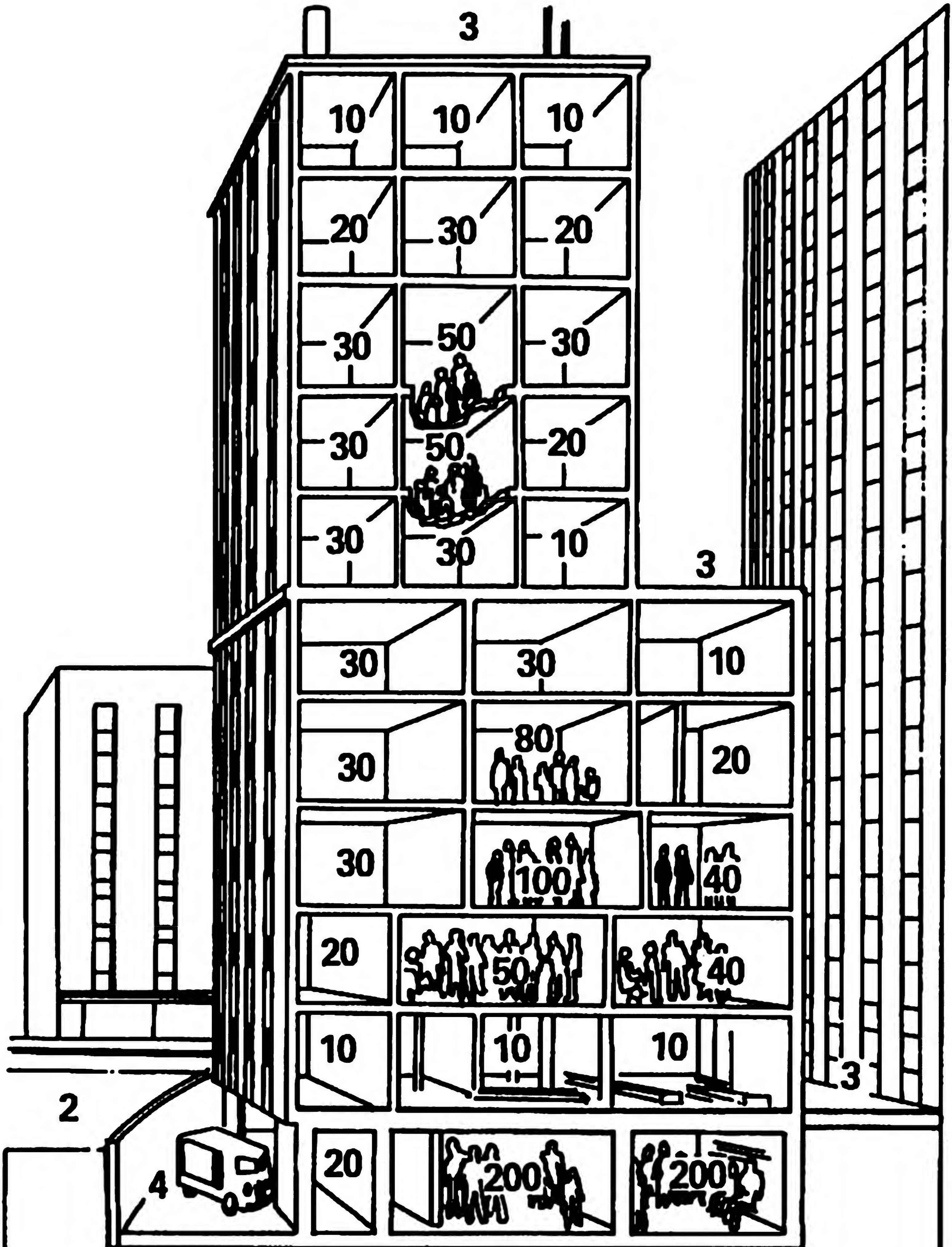
Appointment	*In charge of*	*Composition*	
		Personnel	*Vehicles*
Column Ambulance Officer Deputy Column Ambulance Officer	Ambulance Column comprising one Ambulance Company and one First Aid Company	334 (including drivers for staff cars and D.Rs.)	72 Ambulances 18 Personnel and Equipment Vehicles 10 Staff cars 10 Motor cycles
Company Ambulance Officer Deputy Company Ambulance Officer	Ambulance Company comprising four Ambulance platoons	187 (including drivers for staff cars and D.Rs.)	72 Ambulances 5 Staff cars 4 Motor cycles
Company First Aid Officer Deputy Company First Aid Officer	First Aid Company comprising three First Aid platoons	141 (including drivers for staff cars and D.Rs.)	18 Personnel and Equipment Vehicles 4 Staff cars 3 Motor cycles
Platoon Ambulance Officer Deputy Platoon Ambulance Officer	Ambulance platoon comprising three Ambulance detachments	45 (including driver for staff car)	18 Ambulances 1 Staff car
Platoon First Aid Officer Deputy Platoon First Aid Officer	First Aid platoon comprising six First Aid Parties	45 (including driver for staff car)	6 Personnel and Equipment Vehicles 1 Staff car
Ambulance Detachment Leader Deputy Ambulance Detachment Leader	Ambulance detachment	14	6 Ambulances
First Aid Party Leader Deputy First Aid Party Leader	First Aid party	7 (including driver)	1 Personnel and Equipment Vehicle

Note: Personnel and Equipment Vehicles (PEVs) Staff cars and motor cycles will not be issued for training purposes.

THE MOVEMENT OF AMBULANCES



F.M.A.U. = FORWARD MEDICAL AID UNIT (TRAINED TO APPLY PLASTER OF PARIS TO BROKEN LIMBS, ETC.)



Radiation protection factors in modern city buildings
DCPA Attack Environment Manual, ch. 6, panel 18

SANDIA REPORT

SAND2009-3299
Unlimited Release
Printed May 2009

Analysis of Sheltering and Evacuation Strategies for an Urban Nuclear Detonation Scenario

Larry D. Brandt, Ann S. Yoshimura

Executive Summary

A nuclear detonation in an urban area can result in large downwind areas contaminated with radioactive fallout deposition. Early efforts by local responders must define the nature and extent of these areas, and advise the affected population on strategies that will minimize their exposure to radiation. These strategies will involve some combination of sheltering and evacuation actions. Options for shelter-evacuate plans have been analyzed for a 10 kt scenario in Los Angeles.

Results from the analyses documented in this report point to the following conclusions:

- When high quality shelter (protection factor ~10 or greater) is available, shelter-in-place for at least 24 hours is generally preferred over evacuation.
- Early shelter-in-place followed by informed evacuation (where the best evacuation route is employed) can dramatically reduce harmful radiation exposure in cases where high quality shelter is not immediately available.
- Evacuation is of life-saving benefit primarily in those hazardous fallout regions where shelter quality is low and external fallout dose rates are high. These conditions may apply to only small regions within the affected urban region.
- External transit from a low quality shelter to a much higher quality shelter can significantly reduce radiation dose received if the move is done soon after the detonation and if the transit times are short.

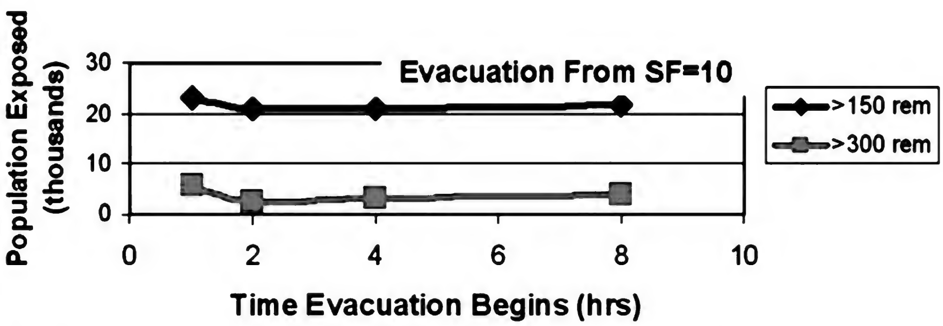
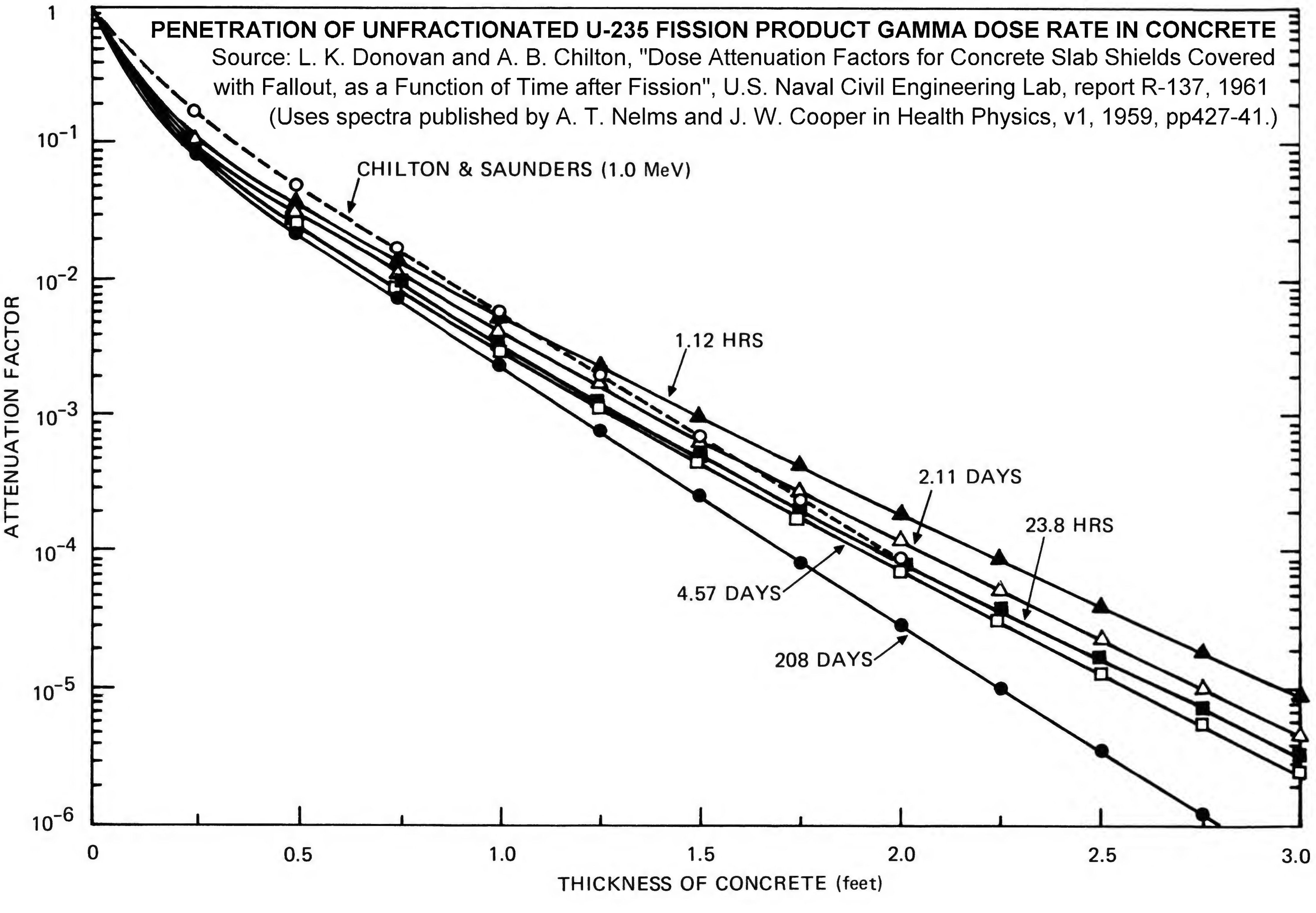


Figure 12. Departure time sensitivities for informed evacuations from shelters with SF=4

Sandia National Laboratories



PENETRATION OF UNFRACTIONATED U-235 FISSION PRODUCT GAMMA DOSE RATE IN CONCRETE
Source: L. K. Donovan and A. B. Chilton, "Dose Attenuation Factors for Concrete Slab Shields Covered with Fallout, as a Function of Time after Fission", U.S. Naval Civil Engineering Lab, report R-137, 1961
(Uses spectra published by A. T. Nelms and J. W. Cooper in Health Physics, v1, 1959, pp427-41.)
CHILTON & SAUNDERS (1.0 MeV)
1.12 HRS
2.11 DAYS
23.8 HRS
4.57 DAYS
208 DAYS
ATTENUATION FACTOR
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
THICKNESS OF CONCRETE (feet)
0
0.5
1.0
1.5
2.0
2.5
3.0

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AND THE CENTRAL OFFICE OF INFORMATION

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The Hydrogen Bomb

HER MAJESTY'S STATIONERY OFFICE

NINEPENCE NET

"The hydrogen bomb has made an outstanding incursion into the structure of our lives and thoughts"

SIR WINSTON CHURCHILL

IN 1956 a comprehensive pamphlet on nuclear weapons and their effects was prepared by the Home Office and Scottish Home Department and published by Her Majesty's Stationery Office. Not everyone has the time to read a full technical account of this kind, which is in any case intended chiefly for use in training the civil defence services. There has been a considerable demand for something shorter and this booklet has been prepared to meet that need.

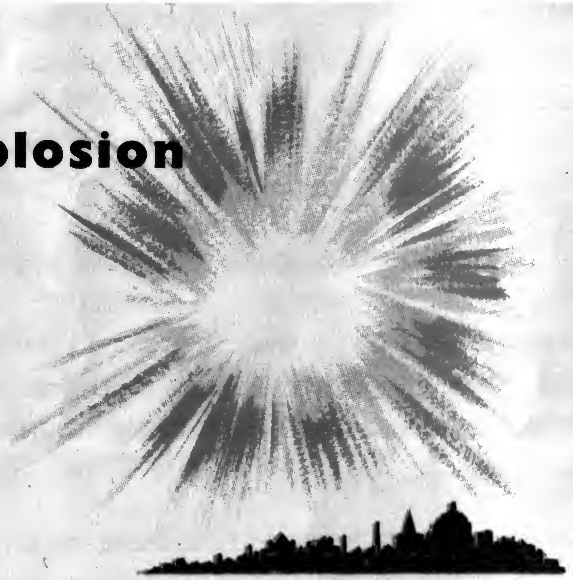
The object is to give, as briefly as possible, the facts about the hydrogen bomb. Knowledge of the effects of this weapon should be widespread. Terrible as these effects are, they can be exaggerated, and the information given in this booklet shows that much could be done to reduce them and to save lives.

This is not intended to serve as a comprehensive manual of instruction to the householder about the steps he could take to help himself and his family should war come: a much fuller booklet is being prepared for this purpose for issue should the need arise; but reference is made to some of the precautions that could be taken.

The publication of this summary does not mean that the Government think war likely. As the 1957 White Paper on Defence made clear, the existence of nuclear weapons and of the means to use them is a safeguard against aggression and a deterrent to war. But everyone should know what these weapons could do, and have some idea of how their effects could be reduced.

If more information is required, reference should be made to "Civil Defence Pamphlet No. 1 on Nuclear Weapons, published by Her Majesty's Stationery Office at 2s. 6d.

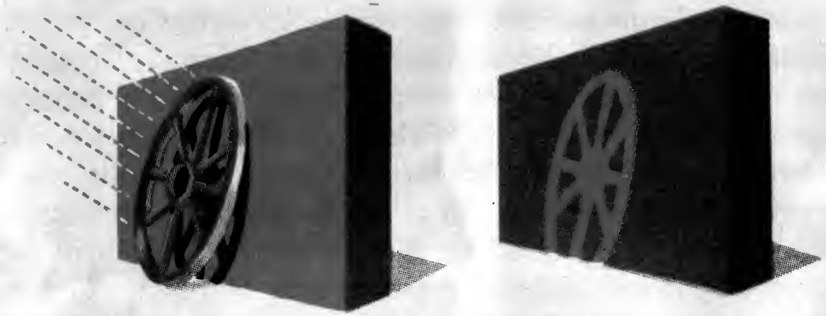
What a Nuclear Explosion is like . . .



A NUCLEAR BOMB is a device whose explosion results from the sudden release of the vast amount of energy locked up in the core of the atom. This energy is equivalent to the explosion of thousands or even millions of tons of high explosive.

The term " nuclear " includes both atomic and hydrogen bombs. These bombs vary in power just as high explosive bombs do. The atomic bomb dropped on Nagasaki, in Japan, at the end of the last war had a power of twenty thousand tons (or twenty kilotons) of high explosive. In a future war hydrogen bombs with a power of ten million tons (or ten megatons) of high explosive or more might be used. For the purposes of this booklet a ten-million-ton bomb has been assumed. We shall see that such an increase in the size of these terrible weapons does not bring a corresponding increase in their destructive power.

Anything that keeps off the sun's heat will help to give protection against the heat of a nuclear bomb. At Hiroshima, for instance, a painted surface was scorched except where it was in the shadow of a wheel.



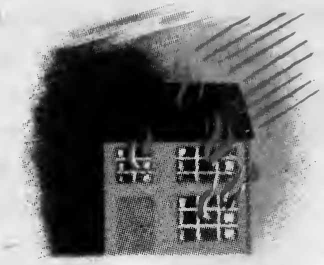
The protection given by clothing depends on the distance from the explosion. The chances of escaping serious burns are increased by wearing hat and gloves and slacks or trousers. At Hiroshima some Japanese women, who had on white cotton dresses with a darker pattern, suffered burns only beneath the pattern. The skin under the white material escaped. This was because white or light-coloured material reflects heat while dark material absorbs it. Colour apart, woollen clothes would be less likely to catch fire than cotton. If clothing did catch fire and there was no time to throw it off, the best way to put out the flames would be to roll over and over on the ground.

All this applies only to people caught in the path of the heat rays. Any solid substance would give full protection against this danger, and a few minutes' warning of the attack would give people time to take cover. Even if they had not heard a warning, people at a distance who took cover even a few seconds after the explosion of a hydrogen bomb would escape some of the heat.

THE DANGER TO BUILDINGS AND THEIR CONTENTS

Any inflammable material exposed to the heat radiated from the fireball may be ignited. Thus lace curtains in windows greatly increase the fire risk as they in their turn might set light to the contents of a room and in the end might cause a general fire in the building. It must be recognised that within three or four miles of a hydrogen bomb all buildings would be completely, or almost completely, destroyed by the blast. Around this central devastated area fires would break out in a number of damaged houses. At Nagasaki the belt of main fires reached a little over a mile from the atom bomb explosion. With a hydrogen bomb it might reach as far as ten miles, although this distance would be reduced on a dull, misty day. Still farther out, fires might be caused by the effects of blast. Gas mains would be burst, electric wires short-circuited and the contents of domestic fires scattered. Such fires might be expected anywhere up to twenty miles from the explosion.

Window panes should be white-washed and anything inflammable removed from doorways and windows



Otherwise the heat flash will have its best chance to start fires

PRECAUTIONS IN BUILDINGS

Simple precautions can be taken against heat radiation, remembering that brick or stone will not catch fire, but the contents of a house might. The aim would be to prevent as much heat as possible from entering at all. One simple way would be to whitewash the windows. This would block some eighty per cent of the rays and, as they travel at the speed of light, most of the heat would be over and gone before the whitewashed windows could be broken by the slower-moving blast. Also, anything inflammable could be removed from windows and doorways. In built-up areas, the lower storeys would probably be shielded by other buildings. Here a householder would need to pay particular attention to the upper floors with a full view of the sky, and clear the rooms accordingly. If the heat were kept from causing fires by these simple precautions, one of the major hazards would be greatly reduced.

Equally simple measures could be taken to prevent fires caused by blast. Stoves could be shut down, coal and electric fires extinguished, and gas shut off at the main.

Many of the fires caused by a hydrogen bomb could be put out by the methods familiar in the last war : by beating or with a stirrup pump, or with a bucket of sand or water. If his house was not too badly damaged, a householder's first job after an explosion would be to look for such small fires and put them out. Speed would be all-important. Only when they had looked round and dealt with any fires would people take shelter from possible approaching fall-out.

★ ★

The stairs would give some protection against falling debris

Best at resisting pressure are heavily framed steel and reinforced concrete buildings or those with rounded streamlined surfaces. In Nagasaki, for instance, most of the tall factory chimneys survived.

THE DANGER TO PEOPLE

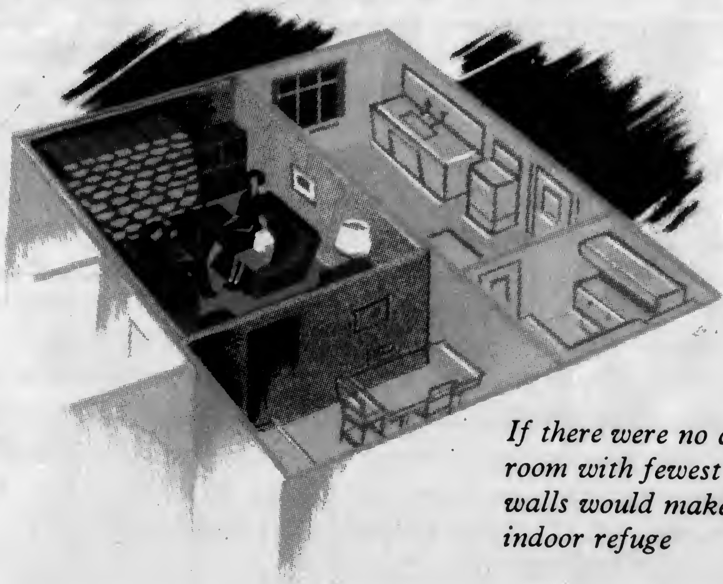
At Hiroshima and Nagasaki very few injuries, such as perforated ear-drums, were caused directly by the blast itself. The real danger is that people would be struck by falling masonry, flying debris or fragments of glass, or might themselves be thrown against some object.

The warning system, however, is designed to enable people to get under cover. A slit trench, especially if covered with a few feet of earth, or a cellar or basement would give good protection. If there were no cellar or basement it would be safest under the stairs, or under a table or bed which would give some protection should the roof or ceiling collapse; and if there were no time to reach such places before the flash is seen, the best place indoors would be close to an inside wall, avoiding windows or anywhere in the possible path of flying glass.

People caught unprotected in the open could at least try to shelter from the rubble and flying debris, if only in doorways or behind walls or even trees. Failing this, they could fall flat on the ground, with the head and face covered, if possible close to the wall of a substantial building, or in a nearby ditch or gutter.

A slit trench with earth covering protects against blast and radiation

A prepared refuge room inside a house could be made to give good protection against fall-out (although not so good as a covered slit trench) and it would also be much less uncomfortable for a period of two days or more. A cellar or basement would be by far the best place for a refuge room ; next best would be the room with the fewest outside walls and the smallest windows. The windows would need to be blocked with solid material, to the thickness of the surrounding walls at least. It would help if the walls themselves were thickened, not necessarily to their full height, with sandbags, boxes filled with earth, or heavy furniture. The occupants of the refuge room would have to remain in it until told that it was safe to come out—perhaps for a period of days—and the room would have to be prepared and equipped accordingly.



If there were no cellar, the room with fewest outside walls would make the best indoor refuge

In some places it might be practicable to make good use of both an outdoor slit trench and an indoor refuge room, using the first for protection against blast, and the second, if the house survived the blast, for subsequent protection against fall-out.

THE ARMED FORCES

Besides the civilian services there would be another important source of help : the Armed Forces. First there would be the Mobile Defence Corps which is organised into fully mobile battalions and especially trained and equipped in rescue and ambulance duties. But all the Armed Forces in the United Kingdom who were not required actively to engage the enemy would have the responsibility of assisting civil defence. Because of the planning and training now in progress they would be able to undertake a wide variety of tasks.

THE NEED FOR CIVIL DEFENCE VOLUNTEERS

The numbers available in the fighting services would, nevertheless, be so small compared with the size of the task that their availability to help in no way lessens the need for civilian forces. The local volunteer would be first in the stricken area and his local knowledge would be needed by any reinforcements coming from farther afield.

CONCLUSION

It is certain that if a nuclear attack were to come, the aid of every man and woman would be needed—service men and civilians alike. Everyone would have to help himself and his neighbour as far as he could. But improvisation would not be enough. The survival of individuals and of groups would depend on plans made beforehand ; adequate help for the victims of attack could come only from people trained and organised in advance.

The picture this booklet has painted of a nuclear attack is grim indeed ; but it is not hopeless. Much could be done. An efficient Civil Defence organisation, linked with a public that knows the facts, could save millions of lives. The best defence against chaos and confusion would be a resolute spirit of self-reliance, based not on groundless optimism, but on knowledge of the facts. That knowledge is none the less valuable because, as all hope, it may never be used.

★ ★

MANUAL OF CIVIL DEFENCE: Vol. I

PAMPHLET No. 1

Nuclear Weapons

CIVIL CD DEFENCE

2nd edition, 1959

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HER MAJESTY'S STATIONERY OFFICE

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Fire protection and precautions

5.13 *Primary fires* would result from heat flash through windows, open doors, etc., igniting the combustible contents in houses, offices and stores. An obvious fire precaution would be to rearrange the furnishings or equipment and to remove all inflammable material out of the direct path of any heat rays that might enter through windows or other openings. Another very important precaution would be to whitewash windows and skylights as this would keep out about 80 per cent. of the heat radiation. The windows might be broken by the blast wave but as this travels more slowly it would arrive after the heat flash had passed (except of course in the central area of complete destruction where it would not matter).

5.14 The above precautions apply to windows and other openings with a direct view of some part of the sky. In a built-up area they would apply more particularly to the windows of upper floors: even from a high air burst the buildings would have a considerable shielding effect on one another.

5.15 *Secondary fires* might be the consequences of blast damage, scattering of domestic fires, rupture of gas pipes or short-circuiting of electrical wiring. These risks could be reduced if commonsense precautions were taken on receipt of a warning, such as shutting up stoves, covering open fires with sand or earth and by turning off gas and electricity at the mains.

The possibilities of a fire storm

5.16 The chief feature of a fire storm is the generation of high winds which are drawn into the centre of the fire area to feed the flames. These in-rushing winds prevent the spread of the fires outwards but ensure almost complete destruction by fire of everything within the affected area. A fire storm inevitably increases the number of casualties since it becomes impossible for people to escape by their own efforts and they succumb to the effects of suffocation and heat stroke.

5.17 The 20 KT Hiroshima bomb (but not the Nagasaki one) caused a fire storm and fire storms were caused in Hamburg* and in several other cities as a result of heavy incendiary attacks in the last war. A close study of these fire storms and of German cities in which fire storms did not occur revealed several interesting features. A fire storm occurred only in an area of substantial size (i.e. several square miles) heavily built-up with buildings containing plenty of combustible material and where at least every other building in the area had been set alight by incendiary attack.

5.18 It seems unlikely that an initial density of fires equivalent to one in every other building would be started by a nuclear explosion over a British city; studies have shown that a much smaller proportion of buildings than this would be exposed to heat flash (due to shielding). Moreover, the vulnerable centres of many British cities were destroyed in the last war and the new buildings which are replacing them are mainly of fire-resistant construction and less closely spaced. Fire storms after nuclear attack are therefore unlikely in most British cities but the risk would be greatly reduced by adopting the precautions outlined above.

---

* About 1,625,000 escaped injury during the fire storm at Hamburg, although out of a population of about 1,700,000 at risk, the 35-40,000 killed represented about 10% of the whole of civilian deaths in Germany from air attack throughout the war.

CHAPTER XI

Summary of Methods of Protection and Decontamination for the Individual

Protective preparations to be taken in an emergency

11.1 All windows and skylights that have a direct view of some part of the sky should be whitewashed. The whitewash would reflect much of the heat of the fireball and so help to stop the heat rays from getting inside the building and setting fire to inflammable objects.

11.2 Attics and lofts should be cleared of all inflammable materials. In other parts of the building, anything inflammable should be removed from the vicinity of windows and other openings, e.g. piles of newspapers on a window-seat or a table near a window.

11.3 Curtains should be removed from windows or made flameproof by soaking in a fire-retardant solution*.

11.4 Baths should be kept full of water and buckets of water should be placed in all rooms for the quick extinction of fires, glowing wood, fabrics, etc.

11.5 The family refuge should be prepared. This should be in the basement or cellar if there is one; otherwise, an innermost room on the ground floor, farthest from external walls and protected by the maximum total thickness of walls on all sides, should be chosen. If a last-war garden shelter is available, the earth-cover should be thickened to about 3 ft.

11.6 The windows of the refuge room should be blocked up or shielded so that they give protection as good as that from the rest of the walls of the refuge, e.g. by erecting a "wall" of sandbags or of boxes filled with earth or sand built up outside the room up to a height of 6 ft. above floor level (or to the top of the window if it is overlooked by trees or by higher ground within 100 ft.).

11.7 Stocks of first aid materials and adequate food supplies for about one week should be collected in or near the refuge: food should be in tins or in waterproof containers or, where appropriate, wrapped in greaseproof paper and put into tins to protect it from plaster, glass and other debris if the house is damaged.

11.8 A supply of drinking water should be stored in jars or bottles, preferably sealed, but at least covered to keep out dust.

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* Suitable solutions for household use are 3 lb. boric acid plus 2 lb. sodium phosphate (or, alternatively, 3 lb. borax plus 2 lb. boric acid) dissolved in 3½ gallons of water. Curtains and fabrics should be thoroughly soaked in the solution and the excess liquid squeezed out before they are rinsed and dried.

11.9 Should there be no indoor W.C., sanitary facilities for use during occupancy of the refuge should be provided.

11.10 In large buildings, natural ventilation should be considered in choosing refuge rooms particularly in a basement. While electrical power remains available, fans should be used either to expel the air from the refuge room through an external vent or to draw fresh air from other spaces within the building. If the building has a forced ventilation system, downward-facing air inlet pipes should be fitted externally and the ends covered with a fine wire gauze screen. If the electrical power fails, sufficient natural ventilation can be achieved if the selected refuge room has an ordinary fireplace and chimney or if it has a ventilation grid near the ceiling opening to the external air, or to some other large space within the building and if, at the same time, the door of the refuge room and all other internal doors on that floor are kept open.

If neither of these conditions is fulfilled, holes could be made near the ceiling in one of the internal walls of each refuge room, opening into larger spaces within the building.

11.11 Bunks or mattresses should be provided as liberally as possible in each refuge room: a person needs nearly twice as much oxygen and exhales twice as much carbon dioxide when sitting as when sleeping and still more when standing and walking about.

Protective measures during and after a nuclear attack

People caught in the open

11.12 No one should be out of doors after a warning of attack had been given except those whose duty required them to do so. Such people would have a specific refuge in mind or at least would know at any moment how to obtain the best protection against the various effects of nuclear weapons.

11.13 If you were out in the open and you saw the flash of the explosion of a nuclear weapon, you might be temporarily blinded but you should try immediately to get behind the best nearby cover that was available, so as to obtain protection from the heat rays and from the effects of the subsequent blast wave and flying debris. Cover on all sides as well as overhead would, of course, be the best: failing that, you should get behind a wall or other solid structure. If there was no other cover, you should lie face down on the ground (in a ditch, gutter or other depression, if possible) using your arms, or a coat or jacket, to cover the head and any exposed skin.

11.14 After the blast wave had passed there would be ample time before the start of fall-out (about half an hour in the case of a large bomb) to enable you to get into a prepared refuge against the fall-out.

People in refuges

11.15 After the blast wave had passed a quick inspection should be made of all rooms in the house or building, including spaces under the roof. Fires which had started and all glowing wood or other material should be extinguished.

11.16 Urgent repairs or weatherproofing which could be completed within half an hour should be done. Curtains or sheets should be tacked over broken windows to keep gross amounts of fall-out from being blown into the rooms. There would be no cause to worry about small amounts of fall-out getting into damaged parts of the house—provided it was not allowed to get into food or water consumed in the refuge room. If dust was visible later in any room it should be swept and dumped outside.

11.17 Except possibly in the area damaged by a nuclear explosion, two separate fall-out warnings* would be given, the *first* to indicate that fall-out was likely, i.e. might arrive at any time after 1 hour and the *second* when it was imminent. After the blast wave had passed and until the imminent warning was received all necessary help and first aid should be given to neighbours.

Protective measures after fall-out had ceased

11.18 You should remain in the refuge for the first 2 days after the explosion or until you had been told that your district was free from radioactive fall-out. If you did not receive any instructions you should stay in your refuge as long as possible (i.e. you should not remain any longer than was necessary in other parts of your house). Above all, you should not go out of doors until you received further instructions. If you were well inside the fall-out area it might not be possible to get further information or instructions to you until the third or even fourth day after the explosion.

11.19 These instructions would tell you how many hours you might safely spend each day out of your refuge (*a*) in other parts of your house (where the shielding is less) and (*b*) outdoors getting food rations and other needs for your family. They would also tell you WHERE and WHEN to go for these food, water and medical supplies so that you would not have to wait and be exposed unnecessarily to a high dose-rate. When you had to go outside for this purpose you should use, if possible, quick means of transport (bicycle or car) so that you could reduce your exposure outdoors to the absolute minimum.

11.20 The advice given to you would depend on the type of house you lived in and amount of shielding it afforded against gamma radiation. The advice would be designed to let you have as much freedom as possible without incurring radiation sickness. It would be essential that you and all members of your family should follow the advice strictly.

11.21 If you did not receive instructions before the end of the third day, it might be because you were in an area of high dose-rate. If so, it would be all the more necessary for you and your family to remain in your refuge room, to spend as little time as possible in other parts of the house and to avoid outdoor exposure until you had been told what you might safely do. 10 R/hr at 48 hours

11.22 If the dose-rate in your area was above a certain intensity you would be given advance notice of arrangements to clear people from the area street by street or maybe house by house. You would be told exactly WHEN and WHERE you would be collected. You would

* See paragraphs 3.4, 3.5 and 8.9.

"Z Zone" FALLOUT EVACUATION

have to be ready at the exact time and place; otherwise, you might imperil not only your own life but the lives of those who were accepting heavy risks, carefully calculated in time, in trying to rescue you and your family and neighbours.

Decontamination of skin and clothing

11.23 It has been explained in paragraphs 8.11 to 8.13 that the hazard from contamination on the skin and clothing is a relatively minor one compared with the hazard caused by the general field of gamma radiation from fall-out. If you suspected that you had been contaminated with radioactive fall-out you should use the following decontamination procedure as soon as you got to your refuge:—

(*a*) Remove all outer clothing and place it in a room or cupboard separate from your refuge room. It would be useful to have bags of polythene or similar material into which contaminated articles could be placed since the bags could be handled later with a much smaller risk of spreading the contamination. In removing the outer clothing, care should be taken *not* to shake it as this would disperse radioactive dust unnecessarily into the atmosphere.

(*b*) The hands, head and neck should then be thoroughly washed and scrubbed with soap and warm water while bending over a hand basin. This washing should be repeated at least once, taking care to brush under the nails thoroughly.

11.24 If you had been covered heavily with fall-out, you might develop skin burns on the exposed parts of the body but these would heal normally provided you had not also been exposed to excessive doses of gamma radiation.

11.25 Contaminated clothing can be cleaned to a very considerable extent (almost complete removal of fall-out particles) by either or, where appropriate, both of the following methods:—

(*a*) Removal of dust from the clothing by means of an efficient household vacuum cleaner, or

(*b*) Soaking and stirring the clothing in a solution of household detergent—either 5 minutes in a washing machine or 5 minutes vigorous stirring (with a suitable stick) in a bath or bucket—followed by thorough rinsing in clean water.

Decontamination of roads and paths

11.26 In urban districts, arrangements might have to be made to decontaminate certain roadways and hard paths around houses which had to be used soon after the two-day refuge period and residents might be asked to help. A certain amount of decontamination could be achieved after a land burst by hosing or swilling contaminated hard surfaces with water if drains are available.

1.22 For every weapon there is an optimum height of burst which will produce the greatest blast effect. In kiloton weapons, this optimum height is significantly greater than the critical height at which the fireball will just touch the ground, e.g. for a 20 KT weapon the critical height is 600 ft. and the optimum height of burst is about 1,000 ft. for damage in a typical British city. The corresponding data for a 10 MT weapon are about 1·36 miles for the critical height and about 1·5 miles for the optimum height.

-this height of burst avoids local fallout (no dust enters fireball)

"Clean" and "dirty" bombs

1.23 Fission products are released by all existing types of nuclear weapon. "Dirty" bombs produce a lot and "clean" bombs produce little, the dirtiness depending upon the ratio of fission to fusion in the bomb. The dividing line between "clean" and "dirty" bombs is thus a matter of opinion, but the fission-fusion-fission type of weapon mentioned in paragraph 1.5 would be a "dirty" one.

Possible methods of attack with nuclear weapons

1.24 Weapon design has improved so much that it is possible to incorporate megaton warheads in a variety of weapons, including ballistic missiles with a range of several thousand miles. Possible means of delivery are listed below:—

(i) Manned bombers (subsonic or supersonic).

(ii) Long-range pilotless aircraft released from land or from ships at extreme ranges. (E.G. "V1" CRUISE MISSILE.)

(iii) Long-range guided bombs released from aircraft several hundred miles from the target.

(iv) Ballistic missiles—IRBM's (Intermediate Range Ballistic Missiles) and ICBM's (Inter-Continental Ballistic Missiles)—released at extreme ranges from land, ships off-shore, or from submerged submarines.

(v) Undercover methods of attack. (TERRORISM.)

1.25 Missiles with wings can be guided over the whole range to the target but since they depend on air to feed the engine, to support the wing loading and to exert forces on control surfaces, they are limited in speed and height of operation and are therefore more vulnerable to counter attack than ballistic missiles. The latter can be guided into the correct direction and altitude to reach the target as long as the rocket motor is operating; thereafter they must follow a ballistic path like a shell from a gun. However, ballistic missiles travel for most of their range at altitudes of several hundred miles where there is practically no air resistance and they can reach maximum speeds of 15,000 miles per hour and average range speeds of several thousand miles per hour. Nothing has been disclosed about the accuracy of existing IRBM's or prototype ICBM's but with good equipment and an efficient guidance system, the error in the point of impact should not be greater than the extreme ranges of damage and fire from larger megaton weapons. Ballistic missiles have one weakness as weapons of war—their trajectory takes them above the earth's atmosphere, and the heating effect due to air friction on re-entry may cause them to heat up and become distorted. This can be avoided at the expense of additional complications in design and

reduced size of warhead, but such weapons will remain vulnerable to the intense heat effect from a defensive nuclear missile detonated in the vicinity of the attacking weapon.

1.26 The major problems in countering attacks from IRBM's and ICBM's within the time available between launching and impact are to detect the weapon, to compute its ballistic path and to fire and detonate a defensive nuclear missile at a high altitude and close enough to its path to destroy it. These problems are being studied and may be solved as a result of further advances in radar tracking equipment and high-speed electronic computing machines.

Factors affecting an attack

1.27 The damage to life and property that might be caused by nuclear detonations would depend upon:—

(i) The bomb power, which might be anything from a few kilotons, up to the megaton range.

(ii) The type of burst, e.g. air, water or ground-burst, and where it occurred.

(iii) The prevailing meteorological conditions, i.e. wind strengths and directions at all levels through which radioactive particles might fall.

(iv) The method of attack and the time available for warning the public to take cover: this might be reduced to minutes in an attack with IRBM's or ICBM's.

(v) The protective measures taken before and after the detonation.

(vi) The knowledge of the public of nuclear hazards, and their sense of discipline and readiness to respond to official advice on protective measures.

(vii) The proficiency of all services connected with civil defence in correctly advising the public, in fighting fires and carrying out other life-saving operations.

Estimation of ranges of effects from bombs of different power

1.28 In planning civil defence operations after an attack with nuclear weapons, information would be needed for each detonation on:—

(*a*) The power or yield of the weapon.

(*b*) The time and the location, i.e. ground zero (GZ) of burst.

(*c*) The height of burst.

(*d*) The wind strengths and directions at all levels up to the top of the highest radioactive cloud.

How this information would be obtained is described in Chapter III.

1.29 When the above facts were known, simple methods would be required for estimating quickly the ranges of the various effects produced by the weapon sizes used. Such estimates would be needed to assess the overall magnitude of the civil defence problems and tasks and they would include the ranges of varying degrees of structural damage, of road blockage, of fires and skin burns and of the main

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TABLE 15

Downwind contamination

Areas of contours at 7 hours after burst, assuming 100 per cent. fission yield

Reference contour dose-rate r.p.h. at 7 hours after burst (DR7's)	*Areas in square miles for weapon power*						
	20 KT	*100 KT*	*½ MT*	*1 MT*	*2 MT*	*5 MT*	*10 MT*
300	0.2	1.2	27	54	108	270	540
100	1.3	6.4	105	210	420	1,050	2,100
30	5	25	325	650	1,300	3,250	6,500
10	16	82	750	1,500	3,000	7,500	15,000
3	50	250	1,650	3,300	6,600	16,500	33,500
1	200	1,000	4,250	8,500	17,000	42,500	85,000

"Z Zone" for evacuation at 48 hours (10 R/hr at 48 hrs = 100 R/hr at 7 hours, due to decay)

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TABLE 18

Half value thicknesses of shielding materials against residual radiation

Material	*Slab density lb. per square foot and per inch thickness*	*Half value thickness (inches)*
Steel ..	41	0.7
Concrete ..	12	2.2
Brickwork	10	2.8
Earth ..	8	3.3

Thus a 2·2 in. thickness of concrete will reduce the dose of residual radiation to one-half of its original value, 4·4 in. will reduce it to a quarter, 6·6 in. to one-eighth and so on. Brick walls 4½, 9 and 13½ in. thick will reduce the intensity of residual radiation by factors of 3, 10 and 30 respectively. As shields are made thicker and larger the contribution from scattered radiation which penetrates increases, so that the reduction factor is slightly more for thinner shields and slightly less for thicker shields than those indicated above.

* The energy of gamma radiation is usually expressed in units of a million electron volts (Mev): the gamma ray released when a nitrogen atom captures a neutron may exceed 10 Mev: the average energy of initial gamma radiation is 4.5 Mev whereas that of residual radiation from fall-out is only about 0.7 Mev. - page 23

† These data are taken from more elaborate data in the series of curves on page 352 of the U.S. publication " The Effects of Nuclear Weapons " (see Preface) where similar curves for neutron and neutron plus gamma doses are shown on pages 366 and 372.

Survey of dwelling houses in the United Kingdom

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9.21 Surveys have been made of different types of dwelling houses in the United Kingdom and their protective factors have been calculated for ground floor refuge rooms in which there is no external door and the windows have been blocked. For this purpose it was assumed that the fall-out is uniformly distributed on the roof and on the ground around the building. The calculated protective factors (which are approximate) are shown in Table 21.

TABLE 21

Approximate protective factors in ground floor refuge rooms of typical British houses with timber upper floors

Types of house	*Protective factor*
Prefab	3
Bungalow	5–10
Detached two-storey	15
Semi-detached two-storey 11 in. cavity walls ..	25–30
Semi-detached two storey 13½ in. brick walls ..	40
Terraced two-storey	45
Terraced back to back	60
Tenements	*

There is some evidence that the fall-out may not all remain on sloping roofs and that consequently the protective factors of most British houses will be higher than the values given in Table 21: this applies especially to the houses with the lower protective factors where a large fraction of the radiation comes from contamination on the low roof.

Basements and trenches

9.22 A substantial increase in protection could be obtained if any of the above houses had an additional cellar or basement, or a trench under the floor: e.g. for a two-storey house the trench would give a protec-

* See paragraph 9.1. Protective factors in tenements can vary widely as they depend upon the size of the building, the massiveness of its construction and the number of storeys used as refuges. On the ground and first floors, PF's may vary from 100 to 500, on second floors the PF may be 50 and on top floors they may be in the neighbourhood of 20.

tive factor (PF) of about 200 and the basement a PF of between 140 and 340, depending on whether or not the basement was adjacent to a semi-sunk area, and if so, on the size of the latter.

9.23 A slit trench with even a light cover of wooden boards or corrugated iron and a tarpaulin will give a protective factor of 5 to 10 and with an additional 3 ft. of earth cover the protective factor will be very high (e.g. 200 to 300 or more).

10.8 The main sources of drinking water in the United Kingdom are underground wells, rivers and impounding reservoirs fed from catchment areas. Wells and reservoirs each supply slightly more than a third of the population and rivers just under a third. *Underground sources* of water would, in general, be free from contamination but if the water is stored in open reservoirs there is a possibility of contamination. *In rivers* many of the fall-out particles would sink to the bottom or be held in mud and vegetation. Some of the active material which dissolves in the river water would be absorbed by mud and vegetation and the rest would ultimately flow to the sea. It seems reasonable to expect that river water would not be contaminated above emergency levels for long periods.

10.9 The large surface areas of *impounding reservoirs* are open to fall-out and the contamination of the water to hazardous levels is therefore possible. It is worth noting in this connection that one of the normal methods of water softening in current use in some industries, known as the base or ion-exchange process, could remove nearly all the radioactive matter dissolved from fall-out.

10.10 As explained in paragraph 10.7 it is proposed to cut off water which is contaminated above the tolerance levels. It is not possible to say for how long, because this would depend upon the level of contamination and the availability of other supplies of fresh water. It would be important for householders to store as much water as possible in order to provide a reserve supply for emergency use. The utmost economy should be exercised in the use of these supplies, some of which should be kept near the emergency refuge.

Industrial cooling water

10.11 Many industrial installations have a small reservoir and recirculating system for cooling water. If possible, the exposed water surfaces should be covered to prevent entry of heavy fall-out. If fall-out did enter, much of it would sink to the bottom or become absorbed in growths on the bottom and walls of the reservoir, and if the depth of water was more than three to four feet, it would be an adequate radiation shield. Provided the water was *not* used for human consumption the soluble radioactive content would present a negligible external radiation hazard when the cooling system was in use.

Sewage disposal

10.12 The harmless disposal of sewage normally depends at some stage on the action of micro-organisms. The risk of injury to the micro-organisms by fall-out is negligible. The main hazard would be possible leakage of radio-strontium, radio-barium and radio-caesium through the sewage plant into a river used as a source of drinking water not far downstream.

10.13 In the event of widespread fall-out in built-up areas, much of the fall-out might be washed by rainfall or in decontamination operations down the gutters and into street drains. To a large extent it would be trapped there until it decayed but it would not constitute

a significant hazard to the public because of the depth of the drains underground. Collaboration of sewage, water and river authorities would be necessary to dispose of the contaminated drainage with least harm to water supplies and to sewage plant, e.g. by arrangement to by-pass it through storm overflows and to stop drawing drinking water supplies from the river during this period.

Food stocks

10.14 It is not the purpose of this pamphlet to review the administrative problems which would face the Ministry of Agriculture, Fisheries and Food after the widespread destruction and the disruption of communications and transport consequent on a nuclear attack on this country. Official reviews of these problems and of the steps being taken to deal with them have been published elsewhere*. This section will be confined, therefore, to basic advice for the protection of people and animals, and their sources of food.

10.15 Many communities isolated by heavy fall-out would have to rely on their available local stocks of food, including that in houses and retail shops, for an indefinite period until arrangements could be made for emergency feeding. It is of vital importance, therefore, that no food be wasted. The monitoring organisation will separate clean from contaminated food and unless the latter is perishable it must be retained until specialist advice has been obtained on how to salvage the maximum amount.

10.16 *Gamma radiation has no harmful effect on foodstuffs* except at dose-rates far in excess of those likely to be encountered where food survives any nuclear detonation. Neutron bombardment might induce some radioactivity but this would not occur outside the area of complete destruction and by the time such food could be salvaged it would be safe to consume. The only significant hazard to food, apart from growing crops, would be the deposition on it of radioactive fall-out which might eventually find its way into the human body. Food contained in impervious wrappings would be safe to eat provided that the wrapping had not been damaged physically. It would be safe to eat provided care was taken to remove the fall-out from the exterior of the container and to prevent contamination of the contents when the container was opened. This would apply also to food in paper wrappings provided the paper had not been soaked with wet fall-out or by subsequent rain (see paragraphs 1.19 and 10.3).

Growing crops

10.17 Heavy fall-out would, of course, preclude any possibility of lifting crops until the dose-rate had fallen sufficiently to permit limited and calculated exposure periods. Crops contaminated with fall-out would need careful handling to prevent the transfer of radioactive matter to the skin, hair or clothing and thence into the mouth or into cuts and abrasions.

10.18 Root crops should be fit for consumption after thorough washing, and so should peas and beans in the pod if the pods were washed before, and the peas after shelling. The hearts of cabbage, sprouts and lettuce should be thoroughly washed after discarding the outer

* See footnote to paragraph 10.2.

(REFERENCE: Dr John F. Loutit and Dr R. Scott Russell "Operation Buffalo, Part 5, The entry of fission products into food chains", Atomic Weapons Research Establishment, report AWRE-T-57/58, May 1959, 216 pages: 90% of Buffalo-2 ground burst fallout was removed from wheat by threshing it. 90% was in the chaff removed by threshing, only 10% on grain.)

leaves. Hard skin-fruits could be washed and peeled but soft fruits should be discarded. Flour produced from cereal contaminated with fall-out would contain only a small fraction of the original contamination. ⇒ 10% for Buffalo-2 nuclear test, see report AWRE-T57/58.

10.19 The effect of fall-out on crops would depend upon their state of growth at the time: if they were in the early stages of growth they would absorb radioactive matter through the root system as well as becoming contaminated on the leaves or other parts above ground. The contamination of the soil present farmers with many other long-term problems. Most of the radioactive components in fall-out would not be washed deeply into the soil but would be retained in the top few inches, and it would be generally advantageous to dig or plough the contamination deeply into the soil and to add lime where there was lime deficiency as this would reduce the uptake by plants of any traces of radioactive strontium which might be present.

"LIME" = Calcium Salts, eg $CaCO_3$

Livestock + add potassium chloride to block Cs-137

10.20 Livestock are affected by fall-out and by radiation in much the same way as human beings. They can suffer radiation sickness, skin burns from fall-out and internal injury to the gastro-intestinal tract when fall-out is swallowed in food or water. As in human beings radio-iodine accumulates in the thyroid gland and radio-strontium accumulates in the bones of animals. In general, the lethal dose depends on size, but among larger animals cattle and horses are slightly more sensitive and sheep and pigs slightly less sensitive than human beings. Except for dairy cattle and breeding stocks, the long-term effects of radiation would be of little consequence because, normally, the animals would be slaughtered long before these effects could become manifest.

10.21 The flesh of animals exposed to initial gamma flash or to residual radiation from fall-out (unless they are in the last stages of illness) would be fit for human consumption provided the bones and the offal were discarded.

10.22 Where practicable, animals should be put under cover and fed with clean food and water, priority being given to breeding stock and dairy cattle.

Milk and eggs

10.23 Cattle secrete in the milk a considerable proportion of the radio-iodine and radio-strontium they absorb. It is anticipated that over large areas of the country the milk produced by cows grazing in the open would be unsafe for infants fed entirely on milk. If facilities were available it would be possible to save contaminated milk by converting it into butter and cheese and storing these products until the radioactivity had decayed, or, in the last resort, by feeding it to animals, e.g. pigs and poultry.

5. It is not possible for a nucleus to consist of protons alone, because the repulsive forces between the positive charges would make them fly apart: in nuclei containing more than one proton this is prevented by the presence of the neutrons and by the attractive forces between the different fundamental particles in close proximity. The atoms of all the elements, with the exception of the simplest type of hydrogen atom, contain at least as many neutrons as protons and the larger the nucleus, the greater is the excess of neutrons over protons needed to hold the nucleus together.

6. All atoms of one element contain the same number of protons but they may have different numbers of neutrons. Thus, several atomic species of the same element are possible and these are called *isotopes* of that element. There is a limit to the number of possible isotopes of each element and those which contain too many or too few neutrons are unstable or radioactive and disintegrate sooner or later, by expelling neutrons or electrons (resulting from the conversion of neutrons to protons) in order to restore the balance in the ratio of neutrons to protons needed for stability. Under those circumstances the electron expelled at high speed from the nucleus is called a beta particle. A succession of changes or disintegration may occur before a stable nucleus is formed and, in many of these, excess energy may be emitted also in the form of gamma rays, an electromagnetic radiation like light or X-rays but of much shorter wavelength. A frequent occurrence, particularly among heavier radioactive atoms, is the expulsion of an alpha particle which is, in fact, the nucleus of the gaseous element helium (containing two protons and two neutrons) without its two outer electrons.

12. Published information suggests that an unconfined sphere of U-235 metal of about 6½ in. diameter and weighing about 48 kilograms would be a critical amount: this would be reduced to about 4½ in. diameter (16 kg.) for a U-235 sphere enclosed in a heavy tamper. The critical sizes for U-233 and Pu-239 have not been disclosed but are somewhat smaller than for U-235. The increasing mechanical complication of bringing together, rapidly and simultaneously, a number of sub-critical pieces of fissile material sets a practical limit to the power of nuclear fission weapons.

Nuclear fission and thermonuclear weapons

13. A temperature of several million degrees centigrade is reached in the detonation of a nuclear fission weapon. At this temperature atoms are stripped of most of their surrounding cloud of electrons and the nuclei move at very high speeds experiencing many collisions with one another. Under these circumstances the nuclei of the rarer hydrogen isotopes deuterium and tritium have enough energy of motion to overcome the repulsive forces between their single positive electrical charges and they are able to fuse together. The energy released in the fusion of these two nuclei is about one-twelfth of that released in the fission of a single U-235 nucleus, but on an equal weight basis, the fusion energy is about two and a half times as large as the energy of fission of U-235.

14. In the process of fusion a neutron is released at a very high speed from each pair of reacting nuclei and it has enough energy to split the commoner atoms of U-238. Thus, if U-238 metal is used as the bomb case in a thermonuclear weapon the quantity of fission products will be increased many times. This type of weapon is the fission-fusion-fission type or so-called "dirty" bomb.

HOME OFFICE

SCOTTISH HOME DEPARTMENT

MANUAL OF CIVIL DEFENCE

Volume I

PAMPHLET No. 1

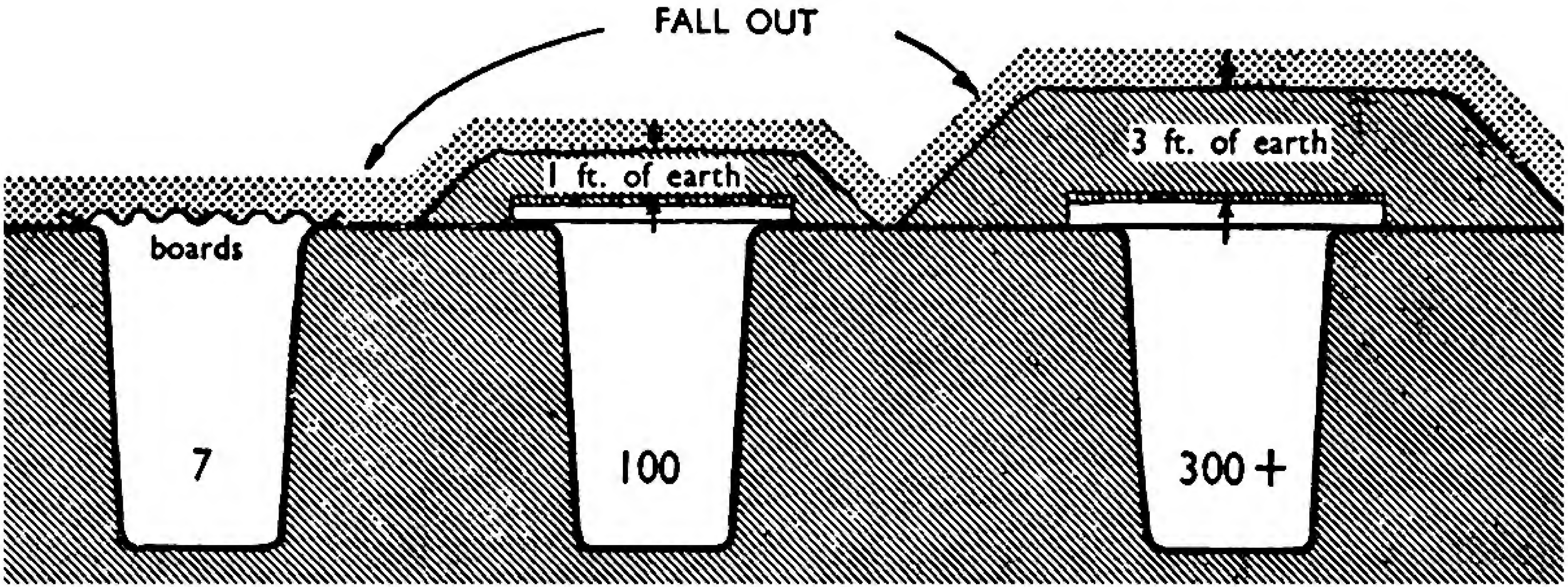
NUCLEAR WEAPONS

LONDON

HER MAJESTY'S STATIONERY OFFICE

1956

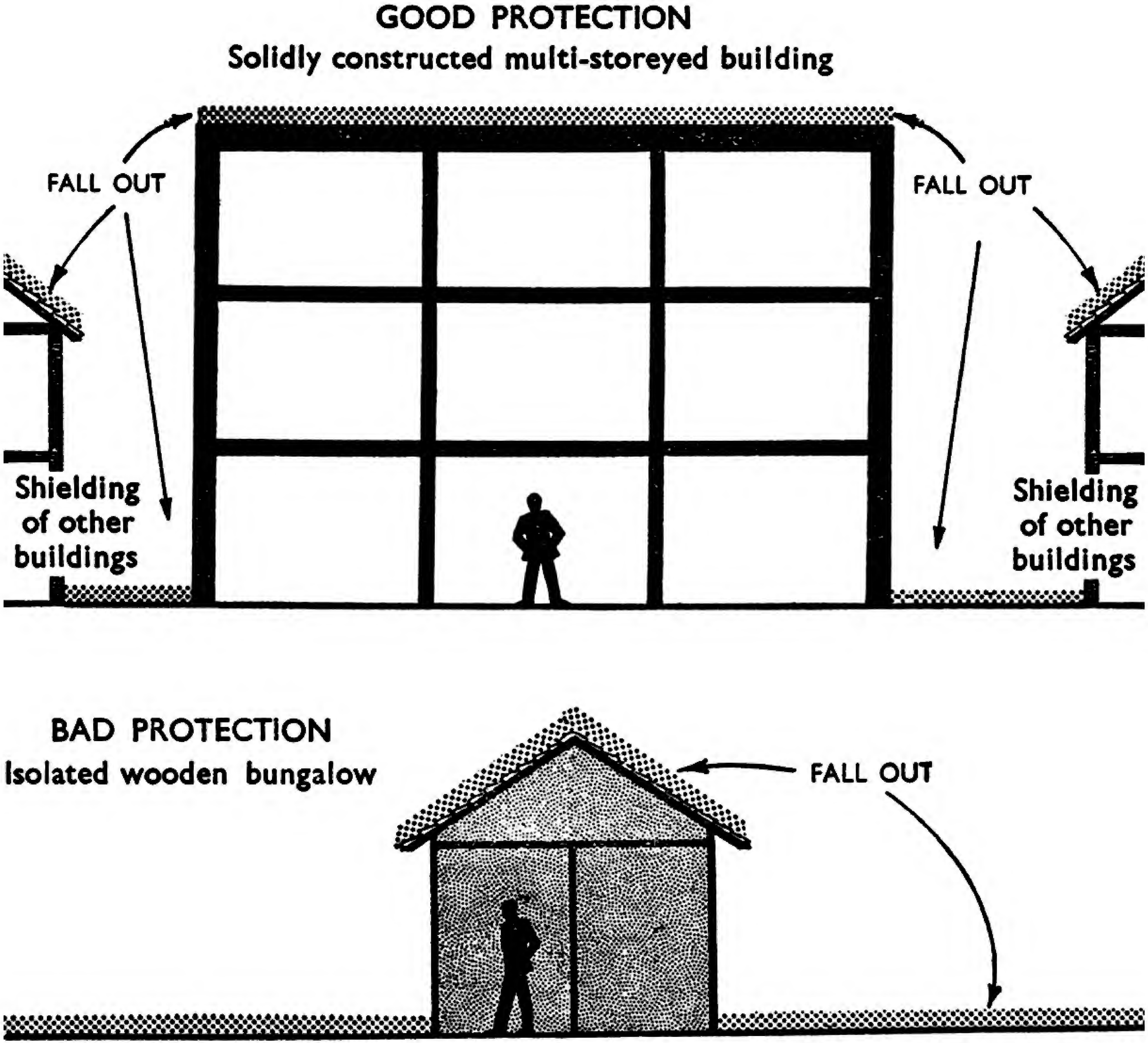
CONTENTS

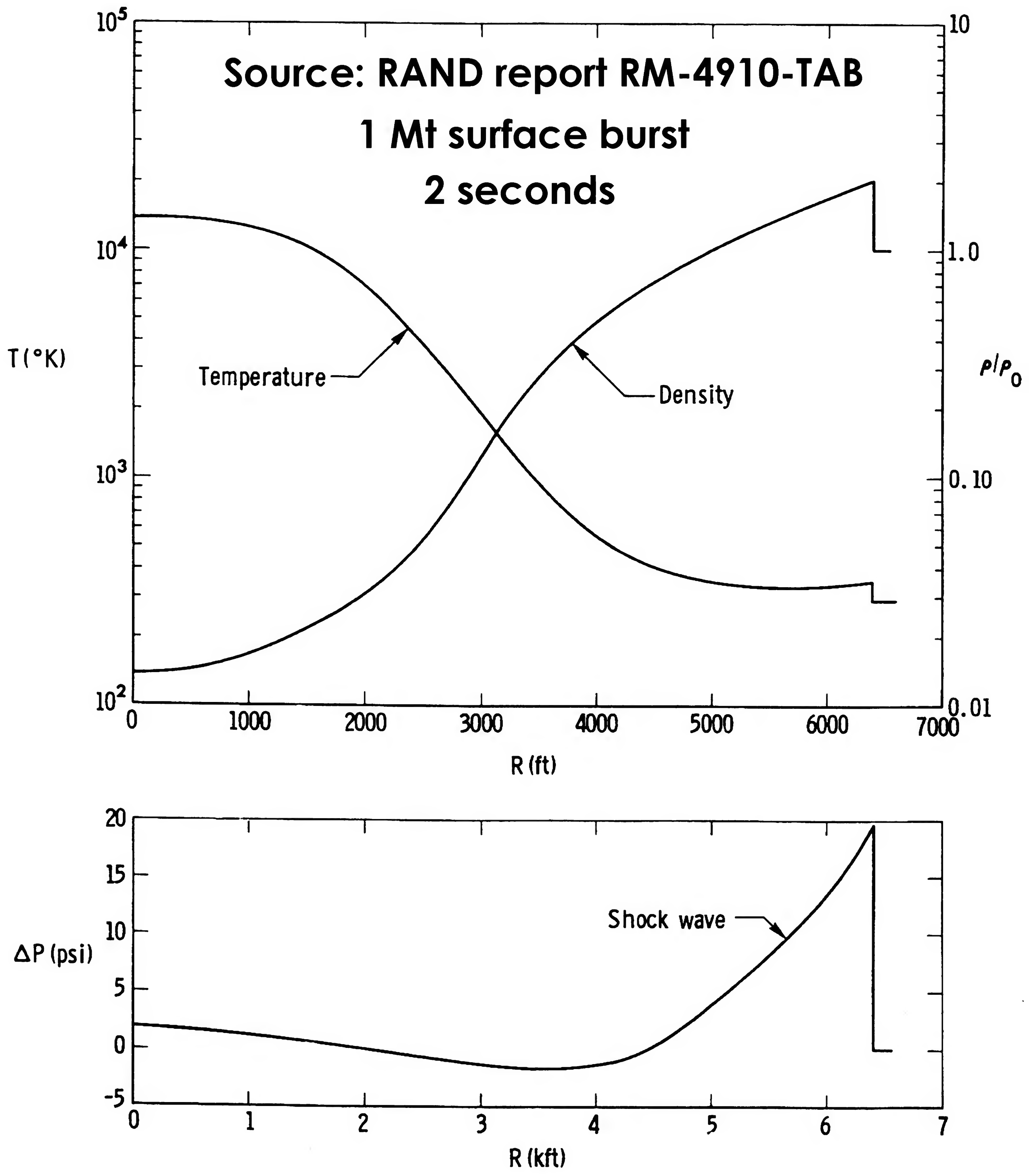


Protection factors in slit trenches (the factor by which the outside dose is divided to get the inside dose).

Choosing a refuge room

In choosing a refuge room in a house one would select a room with a minimum of outside walls and make every effort to improve the protection of such outside walls as there were. In particular the windows would have to be blocked up, e.g. with sandbags.


GOOD PROTECTION
Solidly constructed multi-storeyed building
FALL OUT
FALL OUT
Shielding of other buildings
Shielding of other buildings
BAD PROTECTION
Isolated wooden bungalow
FALL OUT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2 seconds
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10^4
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10
1.0
0.10
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Temperature
Density
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1000
2000
3000
4000
5000
6000
7000
R (ft)
ΔP (psi)
20
15
10
5
0
-5
Shock wave
0
1
2
3
4
5
6
7
R (kft)

The Effects of

Nuclear Weapons

Samuel Glasstone
Editor

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Foreword

This book is a revision of "The Effects of Nuclear Weapons" which was issued in 1957. It was prepared by the Defense Atomic Support Agency of the Department of Defense in coordination with other cognizant governmental agencies and was published by the U.S. Atomic Energy Commission. Although the complex nature of nuclear weapons effects does not always allow exact evaluation, the conclusions reached herein represent the combined judgment of a number of the most competent scientists working on the problem.

There is a need for widespread public understanding of the best information available on the effects of nuclear weapons. The purpose of this book is to present as accurately as possible, within the limits of national security, a comprehensive summary of this information.

Secretary of Defense

Chairman
Atomic Energy Commission

BASIS FOR PROTECTIVE ACTION

12.11 In Japan, where little evasive action was taken, the survival probability depended upon whether the individual was outdoors or inside a building and, in the latter case, upon the type of structure. At distances between 0.3 and 0.4 mile (530 and 700 yards) from ground zero in Hiroshima the average survival rate, for at least 20 days after the nuclear explosion, was less than 20 percent. Yet in two reinforced-concrete office buildings, at these distances, almost 90 percent of the nearly 800 occupants survived more than 20 days, although some died later from radiation injury.

These facts bring out clearly the greatly improved chances of survival from a nuclear explosion that could result from the adoption of suitable warning and protective measures.

TABLE 12.29—ARRIVAL TIME FOR PEAK OVERPRESSURE

Distance (miles)	*Explosion yield*				
	1 KT	*10 KT*	*100 KT*	*1 MT*	*10 MT*
			(Time in seconds)		
1	4. 3	3. 6	3. 7	2. 5	1. 5
2	9	8. 1	7. 4	6. 5	5. 0

12.35. The major part of the thermal radiation travels in straight lines, and so any opaque object interposed between the fireball and the exposed skin will give some protection. This is true even if the object is subsequently destroyed by the blast, since the main thermal radiation pulse is over before the arrival of the blast wave.

12.36 At the first indication of a nuclear explosion, by a sudden increase in the general illumination, a person inside a building should immediately fall prone, as described in § 12.30, and, if possible, crawl behind or beneath a table or desk or to a planned vantage point.

12. 72 Because of its particulate nature, fallout will tend to collect on horizontal surfaces, e.g., roofs, streets, tops of vehicles, and the ground. In the preliminary decontamination, therefore, the main effort should be directed toward cleaning such surfaces. The simplest way of achieving this is by water washing, if an adequate supply of water is available. The addition of a commercial wetting agent (detergent) will make the washing more efficient. The radioactive material is thus tranferred to storm sewers where it is less of a hazard.

Nevada in 1953.

12 calories per square centimeter

ignitable trash

before exposure to a nuclear explosion

after exposure to a nuclear explosion

7.59 The value of fire-resistive furnishing in decreasing the number of ignition points was also demonstrated in the tests. Two identical, sturdily constructed houses, each having a window 4 feet by 6 feet facing the point of burst, were erected where the thermal radiation exposure was 17 calories per square centimeter. One of the houses contained rayon drapery, cotton rugs, and clothing, and, as was expected, it burst into flame immediately after the explosion and burned completely. In the other house, the draperies were of vinyl plastic, and rugs and clothing were made of wool. Although much ignition occurred, the recovery party, entering an hour after the explosion, was able to extinguish the fires.

7.76 It should be noted that the fire storm is by no means a special characteristic of nuclear weapons. Similar fire storms have been reported as accompanying large forest fires in the United States, and especially after incendiary bomb attacks in both Germany and Japan during World War II. The high winds are produced largely by the updraft of the heated air over an extensive burning area. They are thus the equivalent, on a very large scale, of the draft of a chimney under which a fire is burning. Because of limited experience, the conditions for the development of fire storms in cities are not well known. It appears, however, that some, although not necessarily all, of the essential requirements are the following: (1) thousands of nearly simultaneous ignitions over an area of at least a square mile, (2) heavy building density, e.g., more than 20 percent of the area is covered by buildings, and (3) little or no ground wind. Based on these criteria, only certain sections—usually the older and slum areas—of a very few cities in the United States would be susceptible to fire storm development.

CONFI[illegible]

[redacted]

HANDBOOK

on

CAPABILITIES

of

ATOMIC WEAPONS

[redacted]

CONFIDENTIAL

10.3 Damage Criteria

10.32 For those items not included in Table VIII, select the listed item most similar in those characteristics discussed previously as being the important factors in determining the extent of damage to be expected. Perhaps the most important item to be remembered when estimating effects on personnel is the amount of cover actually involved. This cover depends on several items; however, one factor is all important, namely, the degree of forewarning of an impending atomic attack. It is obvious that only a few seconds warning is necessary under most conditions in order to take fairly effective cover. The large number of casualties in Japan resulted for the most part from the lack of warning.

TABLE VIII

ITEM	DAMAGE	AIR SHOCK PSI	REMARKS
Artillery Field (75mm or greater)	Severe	40	Damage to Gun and Cradle
	Moderate	30	Damage to Recoil and Carriage
	Light	5	Damage to Gun Sights
Artillery Field (Less than 75mm)	Severe	25	Damage to Gun and Cradle
	Moderate	15	Damage to Recoil and Loading Mechanism
	Light	5	Damage to Sights
Reinforced Concrete Bldgs.	Severe	25	Collapse
	Moderate	10	Structural damage
	Light	3	Plaster & window damage
Steel, heavy frame Bldgs.	Severe	18	Mass distortion
	Moderate	12	Structural Damage
	Light	3	Plaster & window damage
Steel, light frame Bldgs.	Severe	10	Mass distortion
	Moderate	5	Structural Damage
	Light	3	Plaster & window damage

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DEPARTMENT OF THE ARMY TECHNICAL MANUAL
DEPARTMENT OF THE NAVY
DEPARTMENT OF THE AIR FORCE
MARINE CORPS PUBLICATIONS

TM 23-200
OPNAV INSTRUCTION 03400.1B
AFL 136-1
NAVMC 1104 REV

CAPABILITIES OF ATOMIC WEAPONS (U)

Prepared by
Armed Forces Special Weapons Project

DEPARTMENTS OF THE ARMY, THE NAVY AND THE AIR FORCE

REVISED EDITION NOVEMBER 1957

~~CONFIDENTIAL~~

Personnel in structures. A major cause of personnel casualties in cities is structural collapse and damage. The number of casualties in a given situation may be reasonably estimated if the structural damage is known. Table 6–1 shows estimates of casualty production in two types of buildings for several damage levels. Data from Section VII may be used to predict the ranges at which specified structural damage occurs. Demolition of a brick house is expected to result in approximately 25 percent mortality, with 20 percent serious injury and 10 percent light injury. On the order of 60 percent of the survivors must be extricated by rescue squads. Without rescue they may become fire or asphyxiation casualties, or in some cases be subjected to lethal doses of residual radiation. Reinforced concrete structures, though much more resistant to blast forces, produce almost 100 percent mortality on collapse. The figures of table 6–1 for brick homes are based on data from British World War II experience. It may be assumed that these predictions are reasonably reliable for those cases where the population is in a general state of expectancy of being subjected to bombing and that most personnel have selected the safest places in the buildings as a result of specific air raid warnings. For cases of no prewarning or preparation, the number of casualties is expected to be considerably higher.

6–2

Glass breakage extends to considerably greater ranges than almost any other structural damage, and may be expected to produce large numbers of casualties at ranges where personnel are relatively safe from other effects, particularly for an unwarned population.

Table 6–1. Estimated Casualty Production in Structures for Various Degrees of Structural Damage

	Killed outright	Serious injury (hospitalization)	Light injury (No hospitalization)
1–2 story brick homes (high explosive data):	*Percent*	*Percent*	*Percent*
Severe damage	25	20	10
Moderate damage	<5	10	5
Light damage	......	<5	<5

Note. These percentages do not include the casualties which may result from fires, asphyxiation, and other causes from failure to extricate trapped personnel. The numbers represent the estimated percentage of casualties expected at the maximum range where the specified structural damage occurs.

Personnel in a prone position are less likely to be struck by flying missiles than those who remain standing.

6–3

Table 6–2. Critical Radiant Exposures for Burns Under Clothing

(Expressed in cal/cm² incident on outer surface of cloth)

Clothing	Burn	1 KT	100 KT	10 MT
Summer Uniform	1°	8	11	14
(2 layers)	2°	20	25	35
Winter Uniform	1°	60	80	100
(4 layers)	2°	70	90	120

6–4

3.1 General

For a surface burst having the same yield as an air burst, the presence of the earth's surface results in a reduced thermal radiation emission and a cooler fireball when viewed from that surface. This is due primarily to heat transfer to the soil or water, the distortion of the fireball by the reflected shock wave, and the partial obscuration of the fireball by dirt and dust (or water) thrown up by the blast wave.

~~CONFIDENTIAL~~ 3–1

Measurements from the ground of the total thermal energy from surface bursts, although not as extensive as those for air bursts, indicate that the thermal yield is a little less than half that from equivalent air bursts. For a surface burst the thermal yield is assumed to be one-seventh of the total yield.

3–2 ~~CONFIDENTIAL~~

$$Q=\frac{3.16\times 10^6\ W\ (\overline{T})}{D^2} \text{ cal/sq cm (air burst).}$$

and

$$Q=\frac{1.35\times 10^6\ W\ (\overline{T})}{D^2} \text{ cal/sq cm (surface burst).}$$

where Q=radiant exposure (cal/sq cm)
$\overline{T}$=atmospheric transmissivity
W=weapon yield (KT)
D=slant range (yds).

~~CONFIDENTIAL~~ 3–3

The differences between the air burst and surface burst curves are caused by the difference in apparent radiating temperatures (when viewed from the ground) and the difference in geometrical configuration of the two types of burst.

50 mile visibility and 5 gm/m³ water vapor.
10 mile visibility and 10 gm/m³ water vapor.

3.3 Radiant Exposure vs. Slant Range

a. Spectral. Characteristics. At distances of operational interest, the spectral (wavelength) distribution of the incident thermal radiation, integrated with respect to time, resembles very closely the spectral distribution of sunlight. For each, slightly less than one-half of the radiation occurs in the visible region of the spectrum, approximately one-half occurs in the infrared region and a very small fraction (rarely greater than 10 percent) lies in the ultraviolet region of the spectrum. The color temperature of the sun and an air burst are both about 6,000° K. A surface burst, as viewed by a ground observer, contains a higher proportion of infrared radiation and a smaller proportion of visible radiation than the air burst, with almost no radiation in the ultraviolet region. The color temperature for a surface burst is about 3,000° K. A surface burst viewed from the air may exhibit a spectrum more nearly like an air burst.

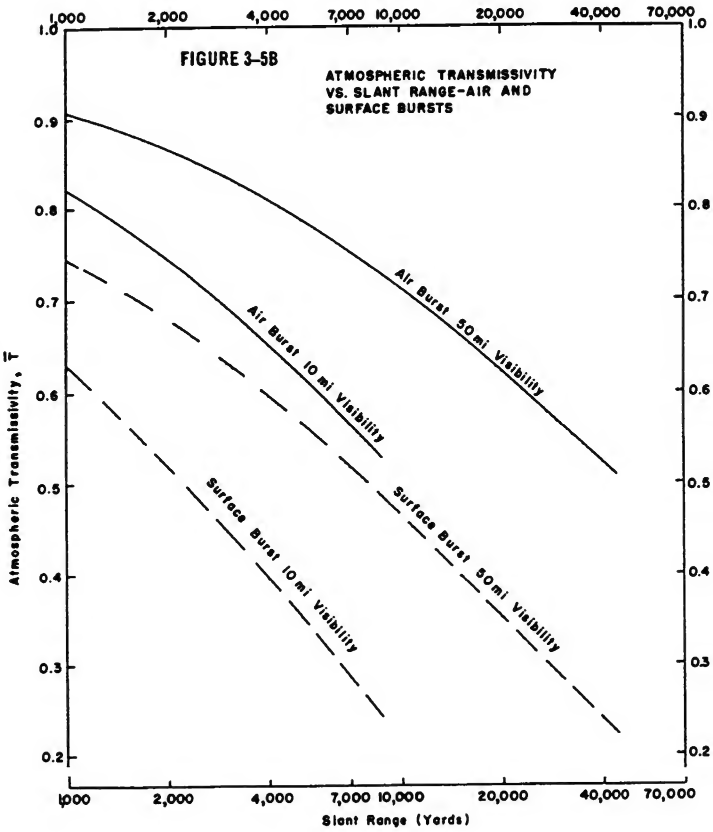


Table 12–2. Critical Radiant Exposure Values for Various Materials

Material	Damage	Critical radiant exposure Q_c (cal/sq cm)		
		1 KT	100 KT	10 MT
Sandbags: Cotton canvas, dry, filled	Failure	10	18	32
Wood, white pine	0.1 mm depth char	10	18	32
White pine, given protective coating	0.1 mm depth char	40	71	126

SECTION VII
DAMAGE TO STRUCTURES

7.1 General

Tunnels in solid rock are difficult to destroy by explosions of nuclear weapons. In this case, the shock wave is transmitted through the rock. When it reaches the tunnel the wave is reflected as a tensile wave, and there is a tendency for the rock to spall or become detached from the rock-tunnel interface. Use of tunnel linings materially reduces this spalling. Mass crushing of the rock and filling of the tunnel occurs closer to the burst point.

7.4 Field Fortifications

a. Air Blast. Air blast is the controlling damage-producing mechanism for destruction of field fortifications, including those reinforced, revetted or covered. Definitions of severe, moderate, and light damage levels to various types of field fortifications are given in table 7–4. These damage levels are based upon various degrees of collapse and structural failure except for unrevetted trenches and foxholes, which have damage levels based on degree of filling caused by collapse of the walls and by filling with dust and debris. Areas covered with loose material, such as sand and gravel, may provide sufficient dust and debris to completely fill a trench or foxhole, whereas areas with stable vegetation or areas of dry silty soil may not provide significant quantities of dust and debris to appreciably fill a trench or foxhole. Collapse of the walls of foxholes and trenches by air blast and air induced ground shock is usually not significant except at ranges less than those shown for severe damage in figure 7–22.

Table 7–4. Damage Criteria for Field Fortifications

Description	Severe
Unrevetted trenches and foxholes with or without light cover.	The trench or foxhole is at least 50 percent filled with earth.

FIGURES 7-20—7-22

The curves in figure 7–22 are based on results of tests run in a *consolidated dry sand and gravel soil.* Trenches and foxholes in damp soil with stable vegetation or dry silty soil will receive moderate and severe damage at ranges less than those shown in figure 7–22. The curves of figure 7–22 are for average rectangular foxholes with the longitudinal axis perpendicular to the direction of air blast propagation. Damage will be equal or less for other orientations.

Given: A 50 KT burst at an altitude of 1,000 feet.

Find: To what horizontal distance there is a 50 percent probability of severe damage to an unrevetted foxhole in a dry, consolidated sand and gravel soil.

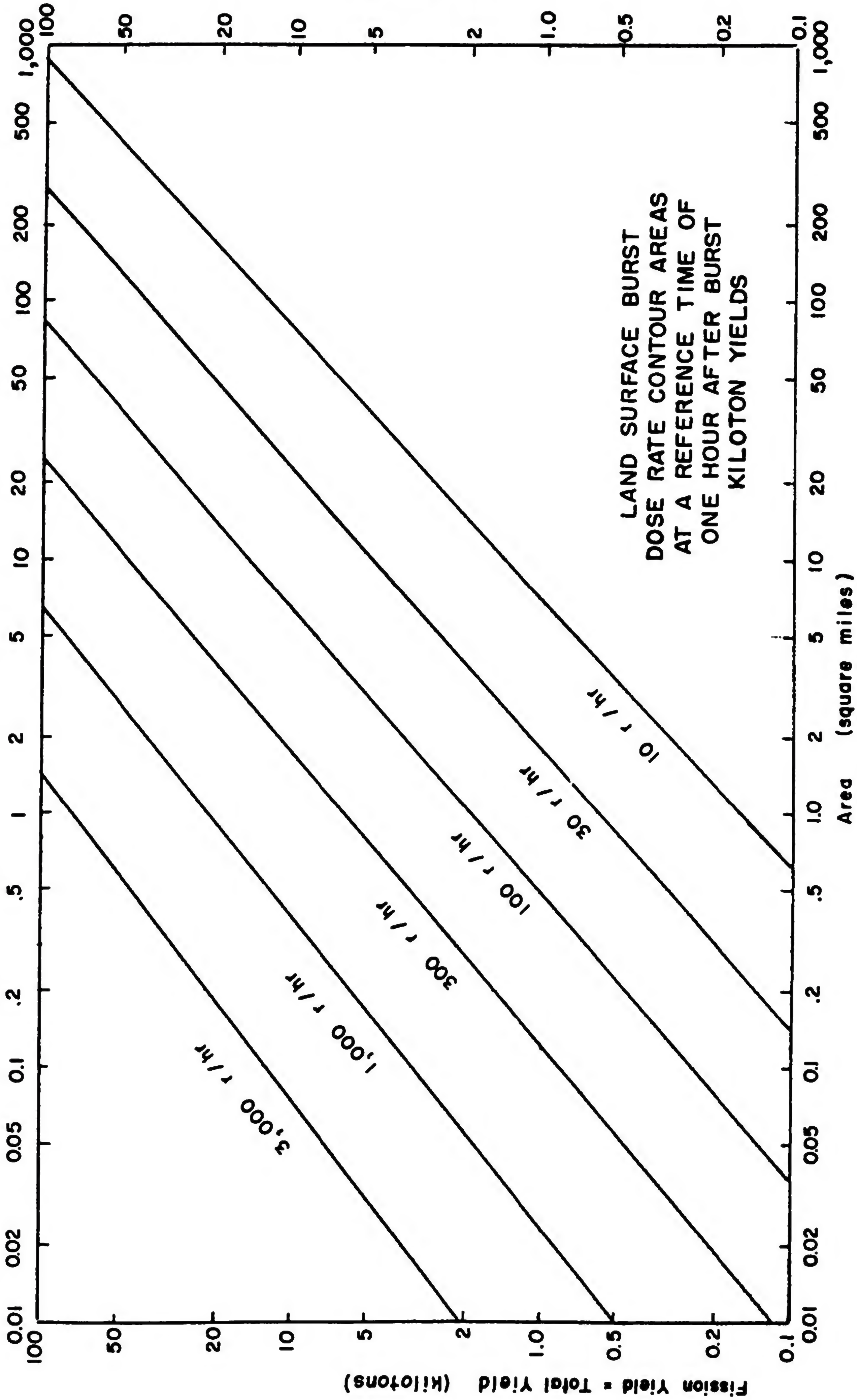
Solution: 680 yards.

Approximately 20 psi peak overpressure

Table 7–3. Damage Criteria for Underground Structures

Structure	Damage	Damage distance	Remarks
Relatively small, heavy, well designed underground targets.	Severe	$1\frac{1}{4}R_a$	Collapse.
	Light	$2R_a$	Slight cracking, severance of brittle external connections.
Relatively long, flexible targets, such as buried pipelines, tanks, etc.	Severe	$1\frac{1}{2}R_a$	Deformation and rupture.
	Moderate	$2R_a$	Slight deformation and rupture.
	Light	$2\frac{1}{2}$ to $3R_a$	Failure of connections. (Use higher value for radial orientation of connections.)

Note. R_a=Apparent Crater Radius.


LAND SURFACE BURST
DOSE RATE CONTOUR AREAS
AT A REFERENCE TIME OF
ONE HOUR AFTER BURST
KILOTON YIELDS
10 r / hr
30 r / hr
100 r / hr
300 r / hr
1,000 r / hr
3,000 r / hr
Area (square miles)
0.01 0.02 0.05 0.1 .2 .5 1.0 2 5 10 20 50 100 200 500 1,000
Fission Yield = Total Yield (kilotons)
100 50 20 10 5 2 1.0 0.5 0.2 0.1

DNA EM-1
PART I

DEFENSE NUCLEAR AGENCY EFFECTS MANUAL NUMBER 1

CAPABILITIES OF NUCLEAR WEAPONS

1 JULY 1972

HEADQUARTERS
Defense Nuclear Agency
Washington, D.C. 20305

FOREWORD

This edition of the *Capabilities of Nuclear Weapons* represents the continuing efforts by the Defense Nuclear Agency to correlate and make available nuclear weapons effects information obtained from nuclear weapons testing, small-scale experiments, laboratory effort and theoretical analysis. This document presents the phenomena and effects of a nuclear detonation and relates weapons effects manifestations in terms of damage to targets of military interest. It provides the source material and references needed for the preparation of operational and employment manuals by the Military Services.

The *Capabilities of Nuclear Weapons* is not intended to be used as an employment or design manual by itself, since more complete descriptions of phenomenological details should be obtained from the noted references. Every effort has been made to include the most current reliable data available on 31 December 1971 in order to assist the Armed Forces in meeting their particular requirements for operational and target analysis purposes.

Comments concerning this manual are invited and should be addressed:

Director
Defense Nuclear Agency
ATTN: STAP
Washington, D. C. 20305

C. H. DUNN
Lt General, USA
Director

Table 10-1 Estimated Casualty Production in Buildings for Three Degrees of Structural Damage

	Percent of Personnel*		
Structural Damage	Killed Outright	Serious Injury (hospitalization)	Light Injury (no hospitalization)
1-2 story brick homes (high-explosive data from England):			
Severe damage	25	20	10
Moderate damage	<5	10	5
Light damage	–	<5	<5
Reinforced-concrete buildings (nuclear data from Japan):			
Severe damage	100	–	–
Moderate damage	10	15	20
Light damage	<5	<5	15

*These percentages do not include the casualties that may result from fires, asphyxiation, and other causes from failure to extricate trapped personnel. The numbers represent the estimated percentages of casualties expected at the maximum range where a specified structural damage occurs. See Chapter 11 for the distances at which these degrees of damage occur for various yields.

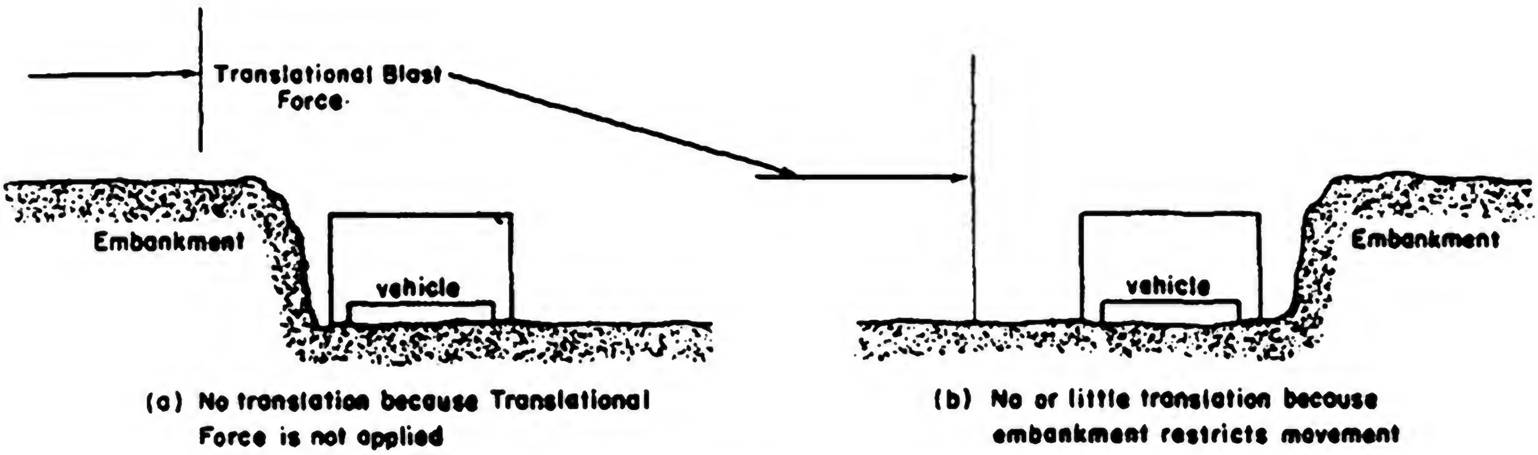


Figure 14-8. The Effect of Shielding

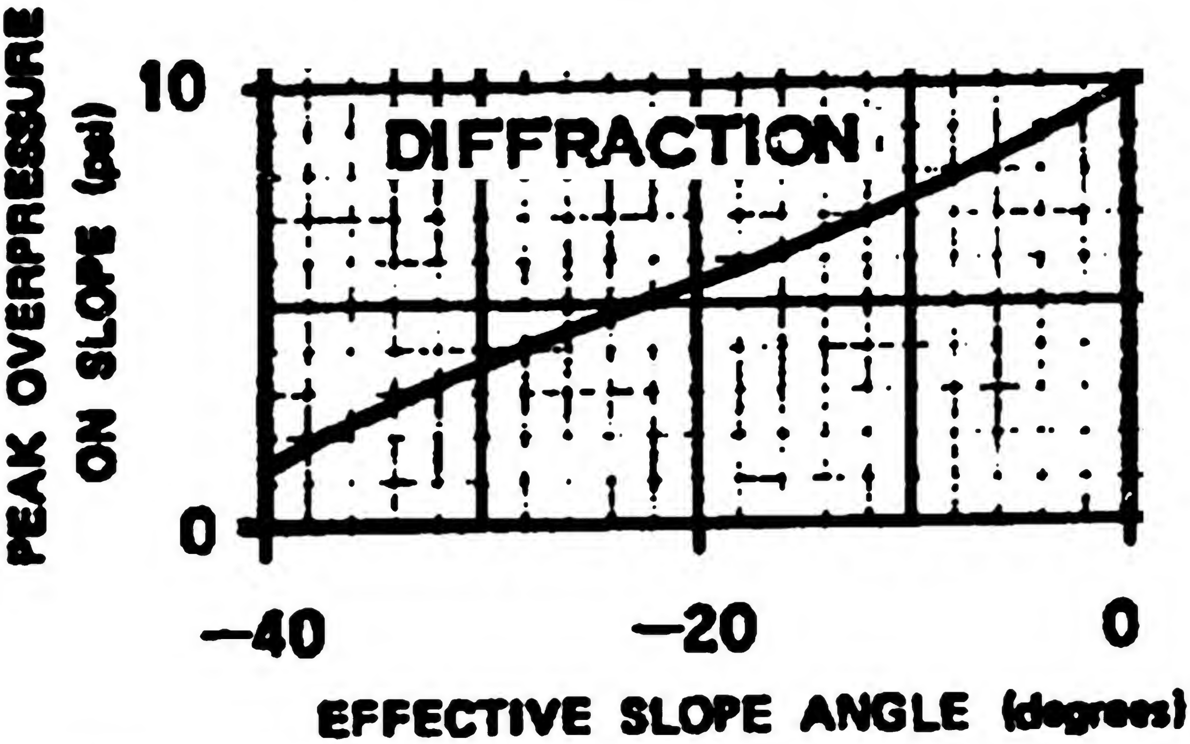


Figure 2-53. Peak Overpressure Produced on a Slope by a 10-psi Incident Mach Stem as a Function of a Slope Angle

If the pulse is of long duration, the ignition threshold rises because the exposed material can dissipate an appreciable fraction of the energy while it is being received. For very long rectangular pulses an irradiance of about 0.5 cal $\cdot$ $cm^{-2} sec^{-1}$ is required to ignite the cellulose. Heat supplied to the material at a slow rate is just sufficient to offset radiative and convective heat losses, while maintaining the cellulose at the ignition temperature of about 300°C.

9-19

Most thick, dense materials that ordinarily are considered inflammable do not ignite to persistent flaming ignition when exposed to transient thermal radiation pulses. Wood, in the form of siding or beams, may flame during the exposure but the flame is extinguished when the exposure ceases.

9-25

MINISTRY OF HOME SECURITY

AIR RAIDS

What You must know
What You must do

LONDON: H. M. STATIONERY OFFICE

Price 3d. Net or 10s. for 50.

FOREWORD

BY

SIR JOHN ANDERSON, G.C.B., G.C.S.I., G.C.I.E., M.P.

Minister of Home Security.

This book is written to help you and your family and your friends.

There has been built up in the last few years a vast organisation for Civil Defence; and, thanks to the devotion of a great army of volunteers, the services which it comprises have been welded into a highly efficient force. This organisation is briefly described in the first chapter, which has been included in this book for two reasons; first, because I may, in the near future, have to call on many of you to give some part of your time to one or other of these services, and secondly, because you may need the help of the services and should therefore understand something about them.

But the Civil Defence services alone cannot protect you from the consequences of air raids. Your own protection and the protection of your family must, in large measure, depend on your taking certain necessary precautions. You can yourself do much to minimise risk to yourself and to those dependent on you.

A great deal of information has been collected as a result of experience gained in actual air raids, and from this and from research and experiment the basic principles on which the protection of life and limb and property depends have been worked out and are set down here for your guidance. They are simple to understand and easy to carry out; and if you will act on them you will be able to face the dangers of air raids with the sure conviction that you have done all in your power for the safety of those depending on you, and with the calmness and assurance that come from a knowledge of the way in which these dangers can be met. In this way you will be helping not only yourself, but the Nation, for it is through the strengthening of your powers of resistance that the people of this country will be enabled to defeat every attempt the enemy may make to weaken its morale and paralyse its war effort.

In this war every man and woman is in the front line. A soldier at the front who neglects the proper protection of his trench does more than endanger his own life; he weakens a portion of his country's defences and betrays the trust which has been placed in him. You, too, will have betrayed your trust if you neglect to take the steps which it is your responsibility to take for the protection of yourself and your family.

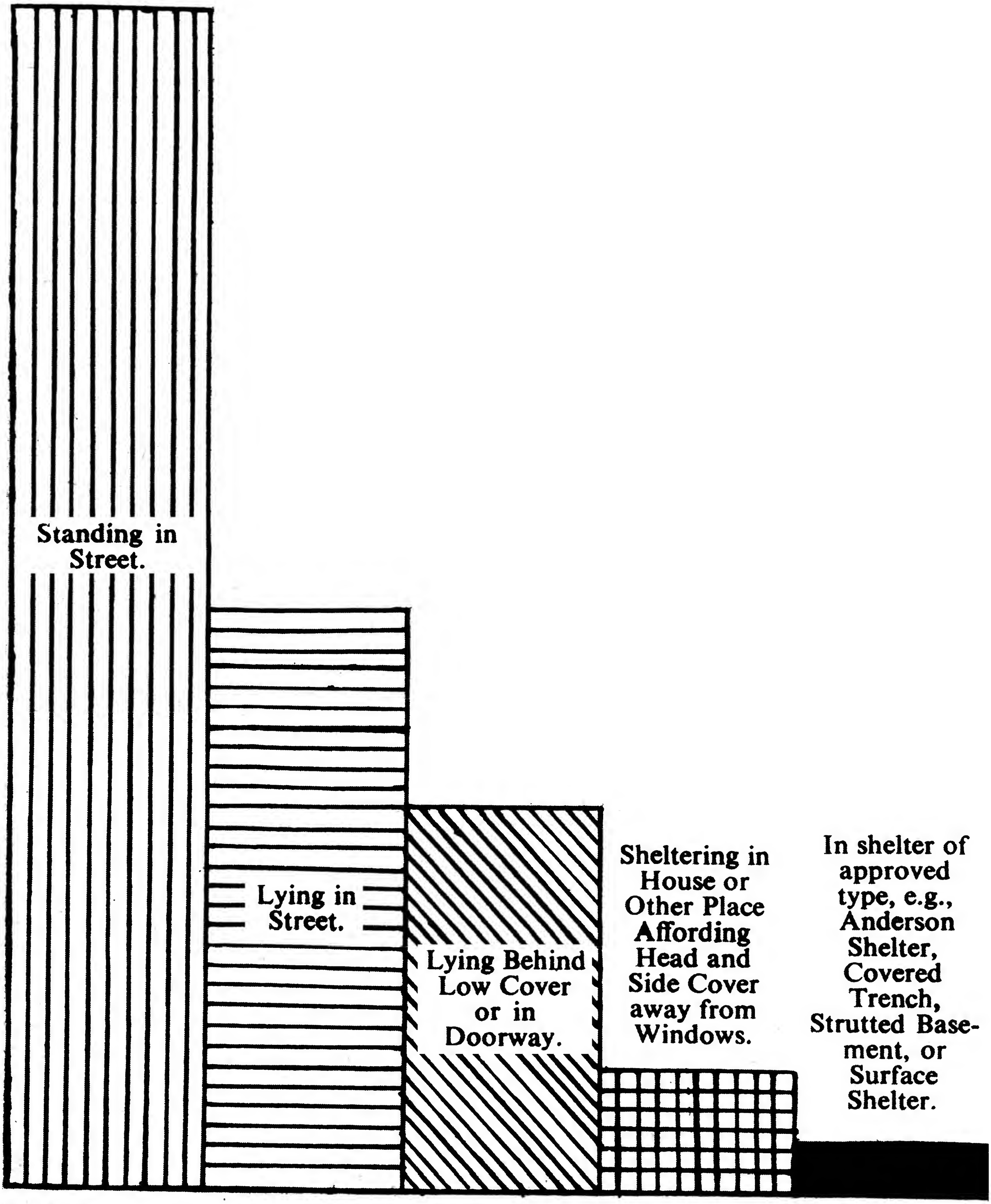
This is a contribution to the winning of final victory which you personally can make and which no one else can make for you. I am confident that you will make it.

Ministry of Home Security.

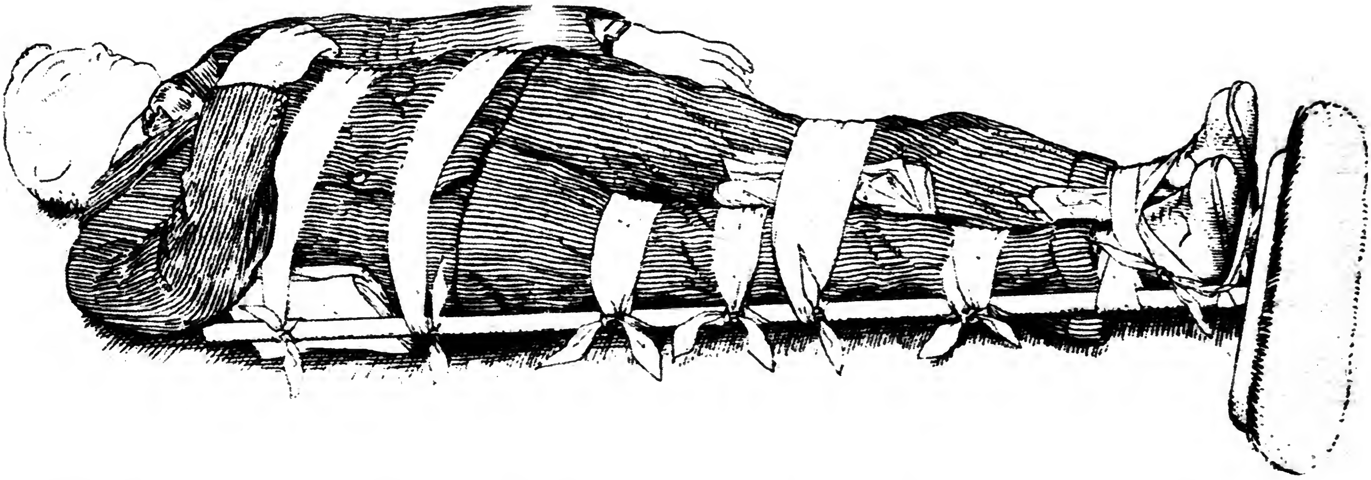
June, 1940.

Tools.

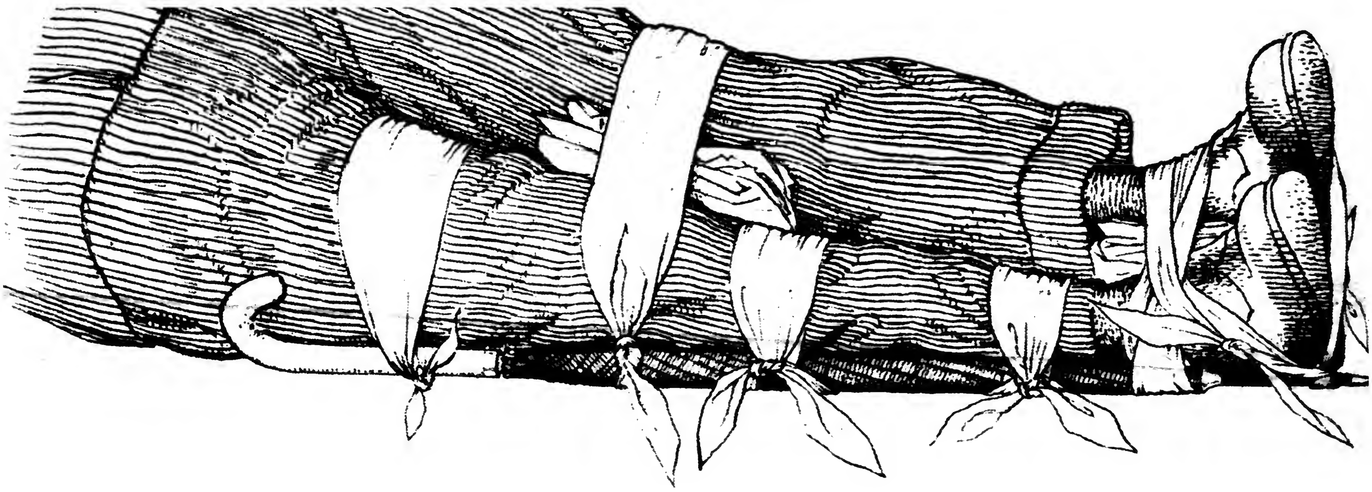
A number of tools such as picks, shovels, and crowbars should be kept in a shelter to be used in forcing a way out if the occupants are trapped. When the accommodation is being fitted out, it should be discovered where the weakest part of the structure is, or where it would be most suitable to work, should it become necessary to break a way out. This position should be clearly marked for the benefit of all.



This diagram is based on a large number of reports of the results of recent air raids and is an approximate indication of the difference in the degree of risk resulting from taking cover in various ways.

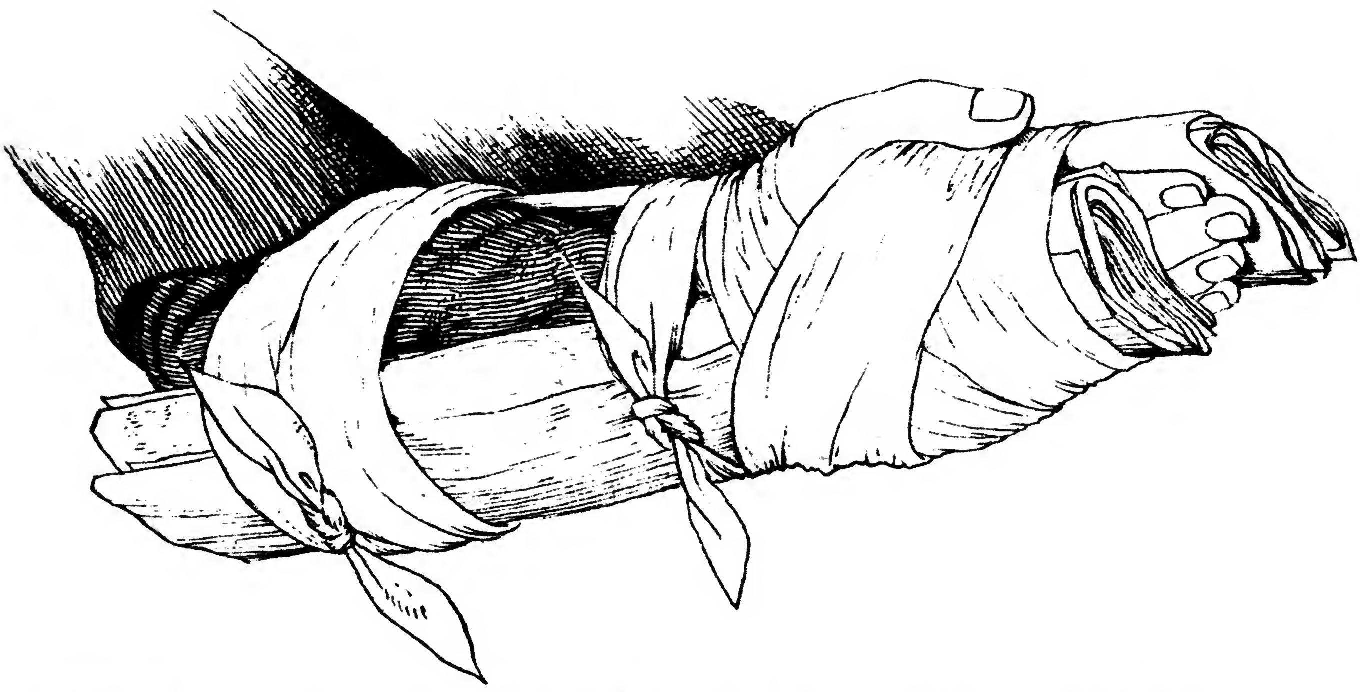


A broom used as a thigh splint by placing the handle along the injured limb, with the head of the broom at the feet. Loosely folded pieces of newspaper or other material may be used as padding, placed between the ankle and knee joints, and also at the hip.



Sketch II.—Simple fracture through middle third of tibia (shin-bone).

The illustration shows an umbrella used as a splint. The ankles and knee joints are padded with loosely folded newspaper.



Sketch III. **Simple fracture through one or both bones of the forearm.**

The illustration shows the use of newspaper, folded to the approximate size of an arm splint, so as to be stiff enough to give rigid support.

AN ANALYSIS OF 259 OF THE RECENT FLYING-BOMB CASUALTIES

BY

R. C. BELL, M.B., M.R.C.S.

Resident Surgical Officer to an E.M.S. Hospital

In all we dealt with 222 out-patients and 259 in-patients, with 18 deaths. Our story began in June, 1944, when the first large incident occurred near by. Twenty-six casualties were admitted and 12 required theatre treatment. This proportion remained fairly constant throughout the series. Altogether we had 83 theatre cases out of 259 admissions, and had to send 35 cases on untreated, most of whom required the theatre. In this first incident no fewer than 16 of the casualties were due to flying glass. It was noticeable how the proportion of glass injuries dropped as the importance of taking adequate cover was realized, while the percentage of crush injuries increased from people being trapped by falling masonry.

A. Flying Glass

This was the most frequent cause of injury, totalling over 100 casualties in all. Many included severe damage to the eyes. It is noticeable that most of the injuries were above the nipple line, chiefly of the face and neck: a large proportion were received when looking out of windows—a modern version of curiosity killing the cat. We had five cases of perforating wounds of both eyes and ten perforating wounds of one eye. The globe was usually completely destroyed. Many of these injuries were avoidable, and therein lay their great sadness.

The penetrating power of flying glass is, in the main, low. It is unusual for it to pierce the deep fascia: usually it lies just under the skin in the fat, but when present in hundreds of pieces it presents a problem which has not yet acquired a satisfactory solution ; nor has the condition made its way into the textbooks of war surgery.

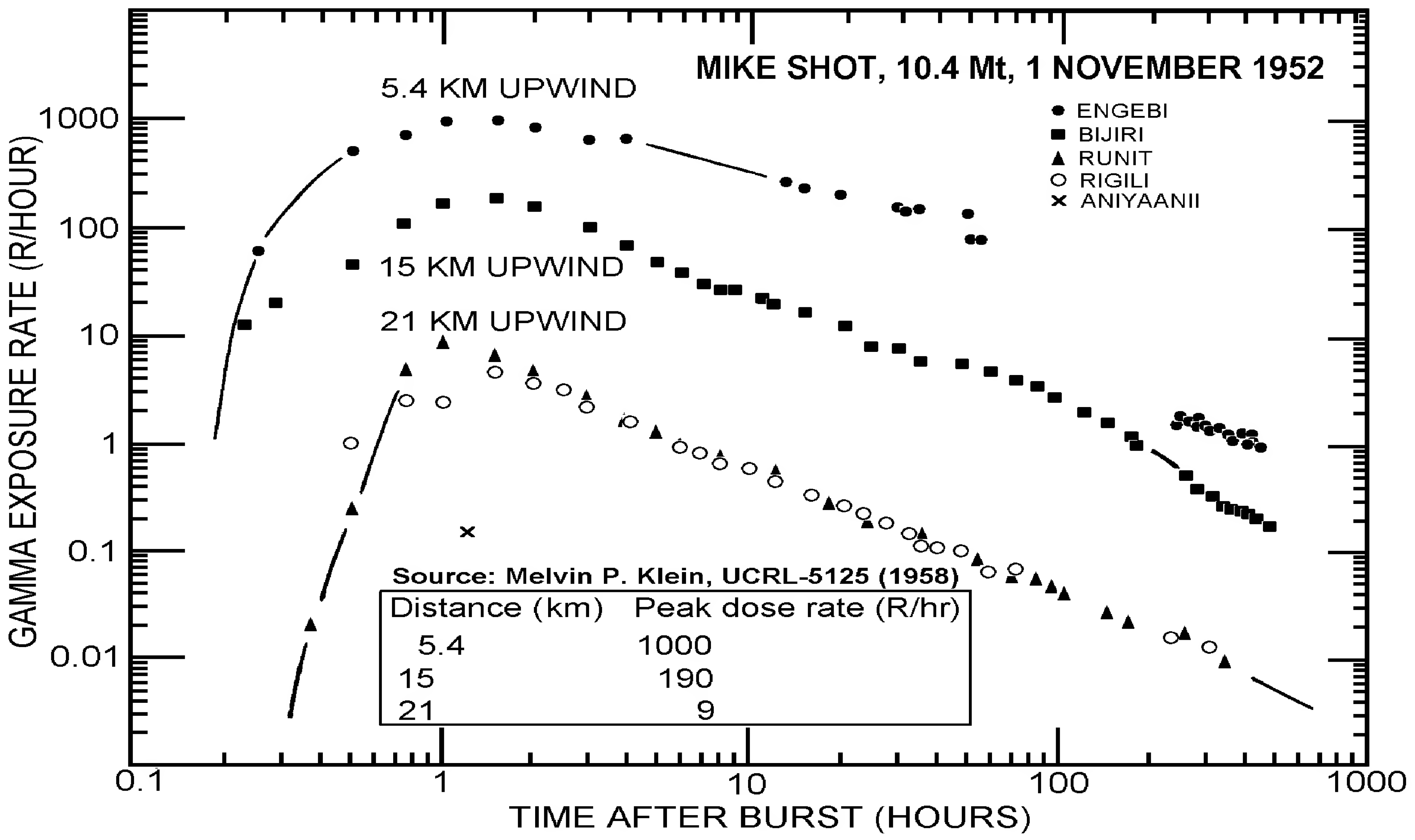
TABLE I.—*Glass*

Description	No.	Remarks	Deaths
Lacerations of face, scalp, and neck ..	77	19 T	—
Perforating wounds of eye	15	5 cases bilateral 2 T	—
Cut hands	9		
Severe multiple lacerations	6	1 T	1
Other injuries	5	—	—

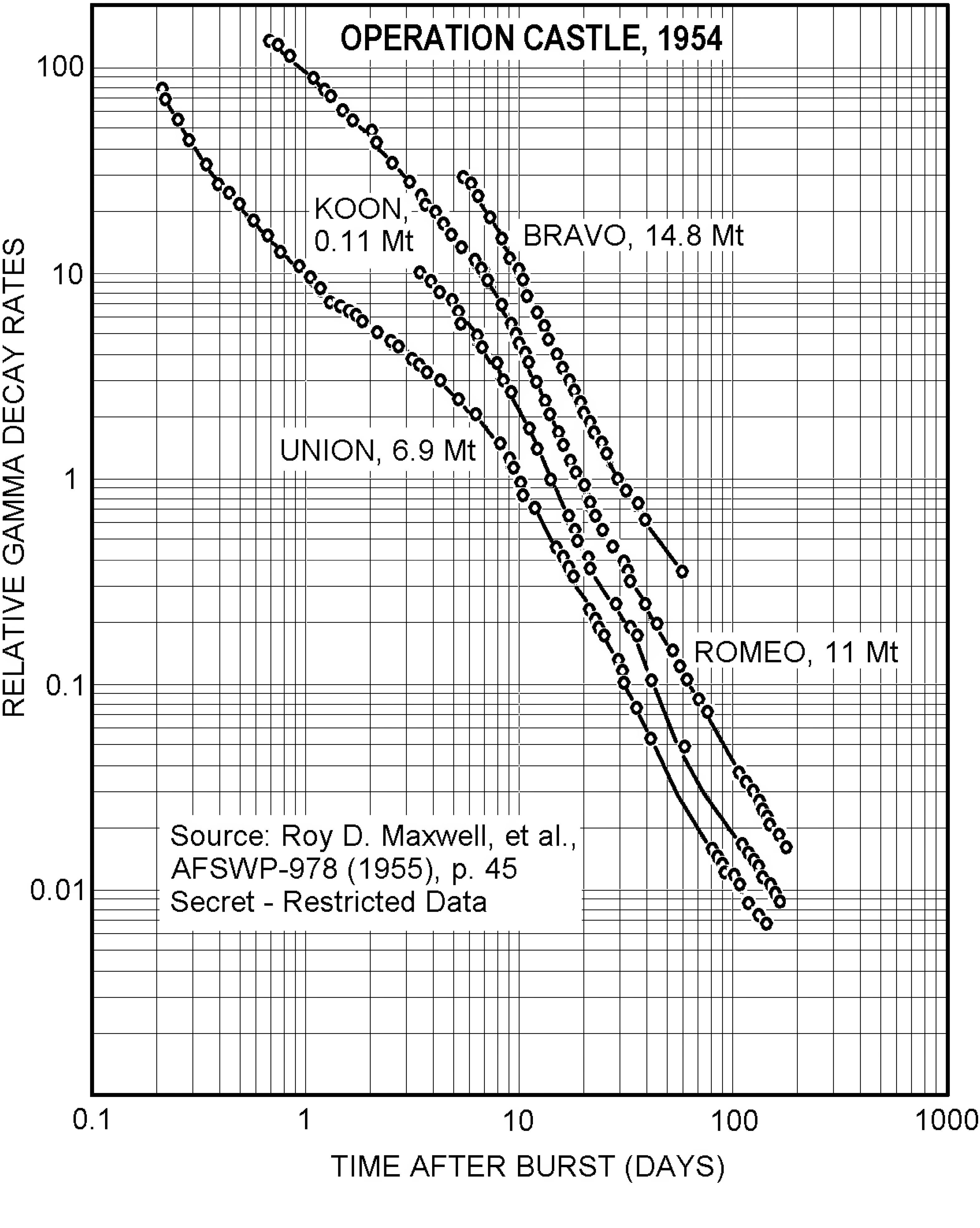
Number and Classification of Official Evacuees in Great Britain in 1939 and 1940

900,000 of the 1.5 million returned to the target areas after four months of war.	September, 1939		January, 1940	
	Number	Percentage Distribution	Number	Per cent of Those in September, 1939
1. Unaccompanied school children	826,959	56.1	457,600	55
2. Mothers and accompanied children	523,670	35.5	64,900	12
3. Expectant mothers	12,705	0.9	1,140	9
4. Blind persons, cripples, and other special classes	7,057	0.5	2,440	35
5. Teachers and helpers	103,000	7.0	46,500	45
Total	1,473,391	100.0	572,580	39

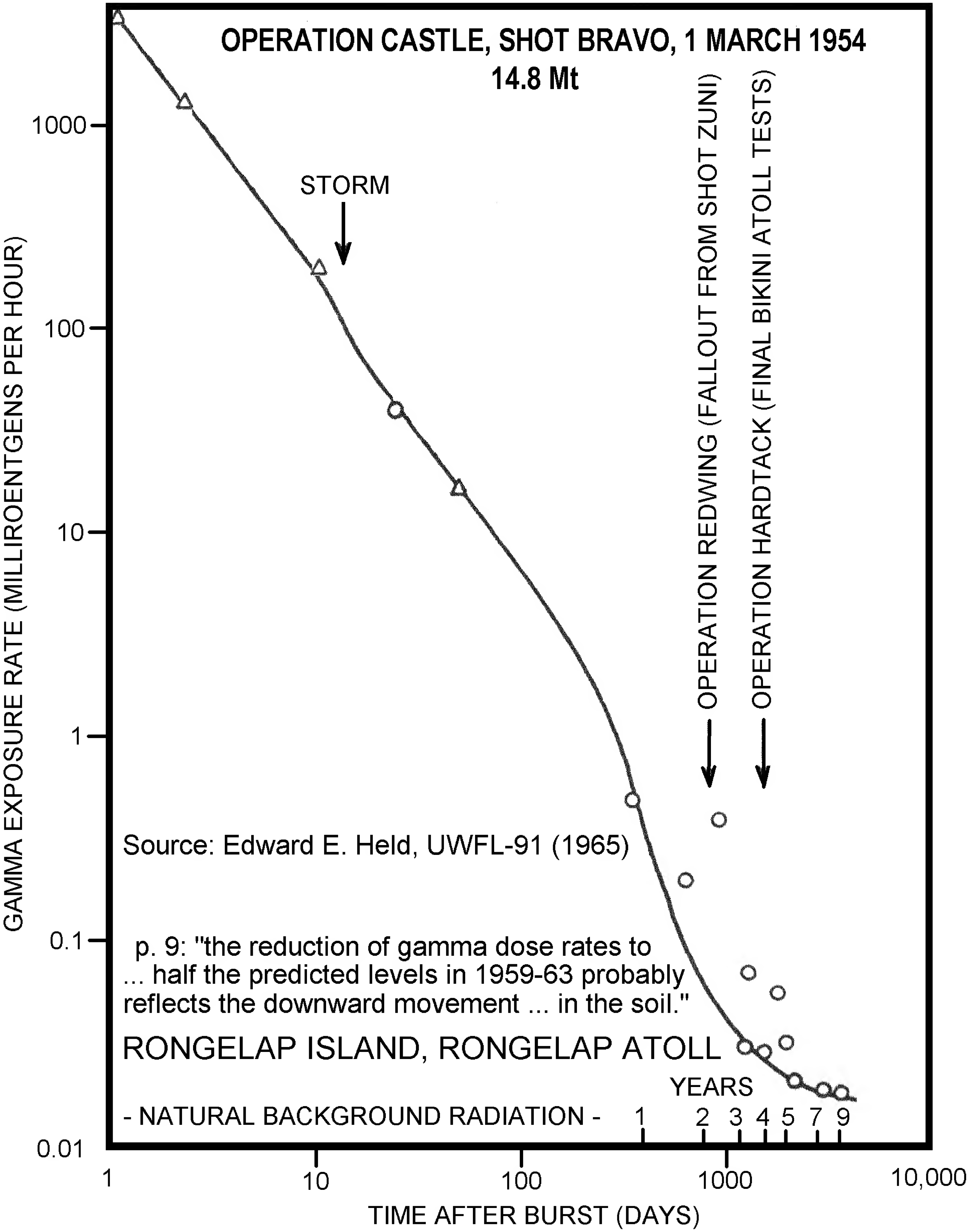
Source: R. M. Titmuss, *Problems of Social Policy* (London: H.M. Stationery Office, 1950), pp. 103 and 172.



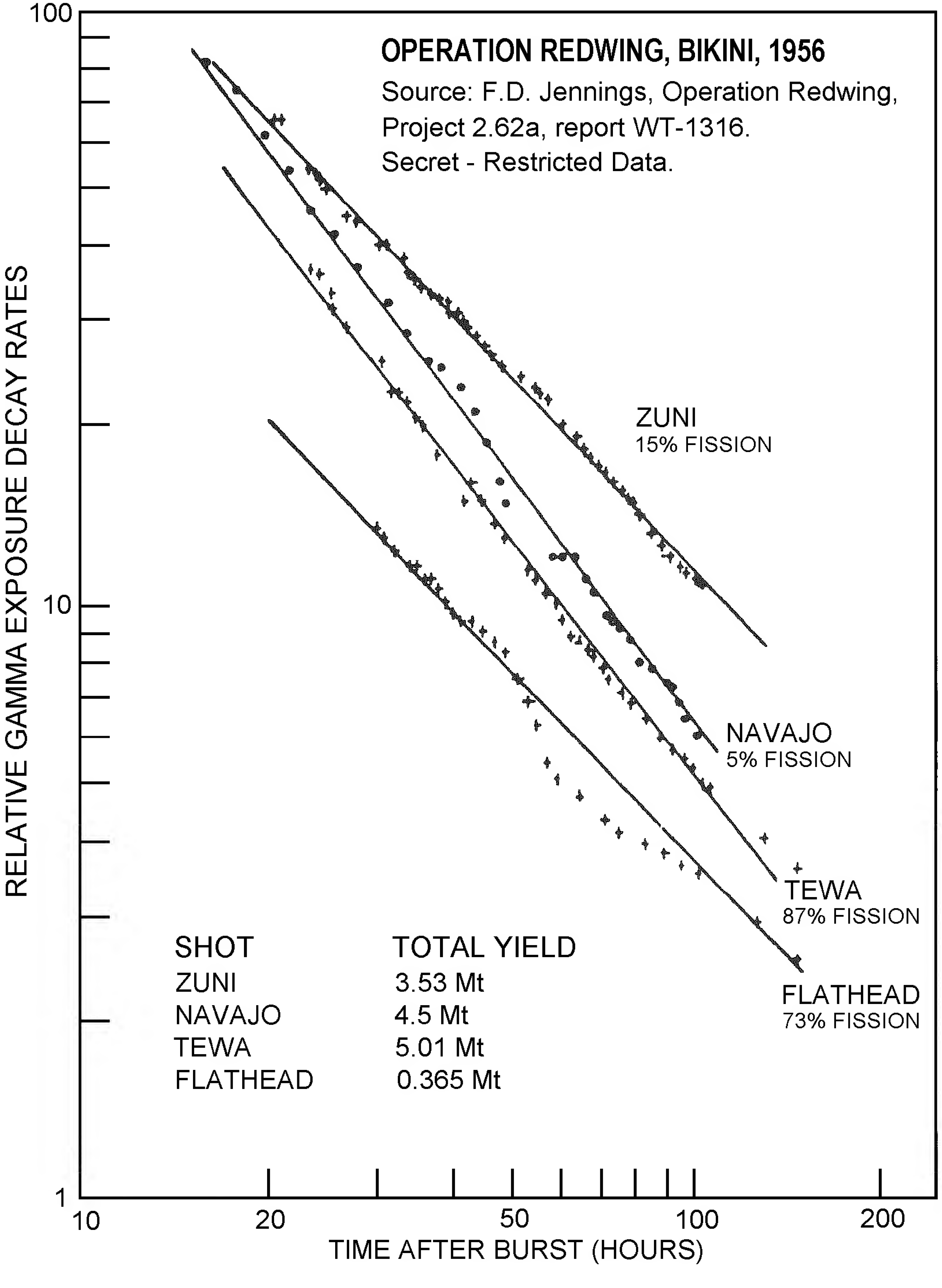
MIKE SHOT, 10.4 Mt, 1 NOVEMBER 1952
5.4 KM UPWIND
15 KM UPWIND
21 KM UPWIND
ENGEBI
BIJIRI
RUNIT
RIGILI
ANIYAANII
Source: Melvin P. Klein, UCRL-5125 (1958)
Distance (km) Peak dose rate (R/hr)
5.4 1000
15 190
21 9
GAMMA EXPOSURE RATE (R/HOUR)
1000
100
10
1
0.1
0.01
0.1
1
10
100
1000
TIME AFTER BURST (HOURS)

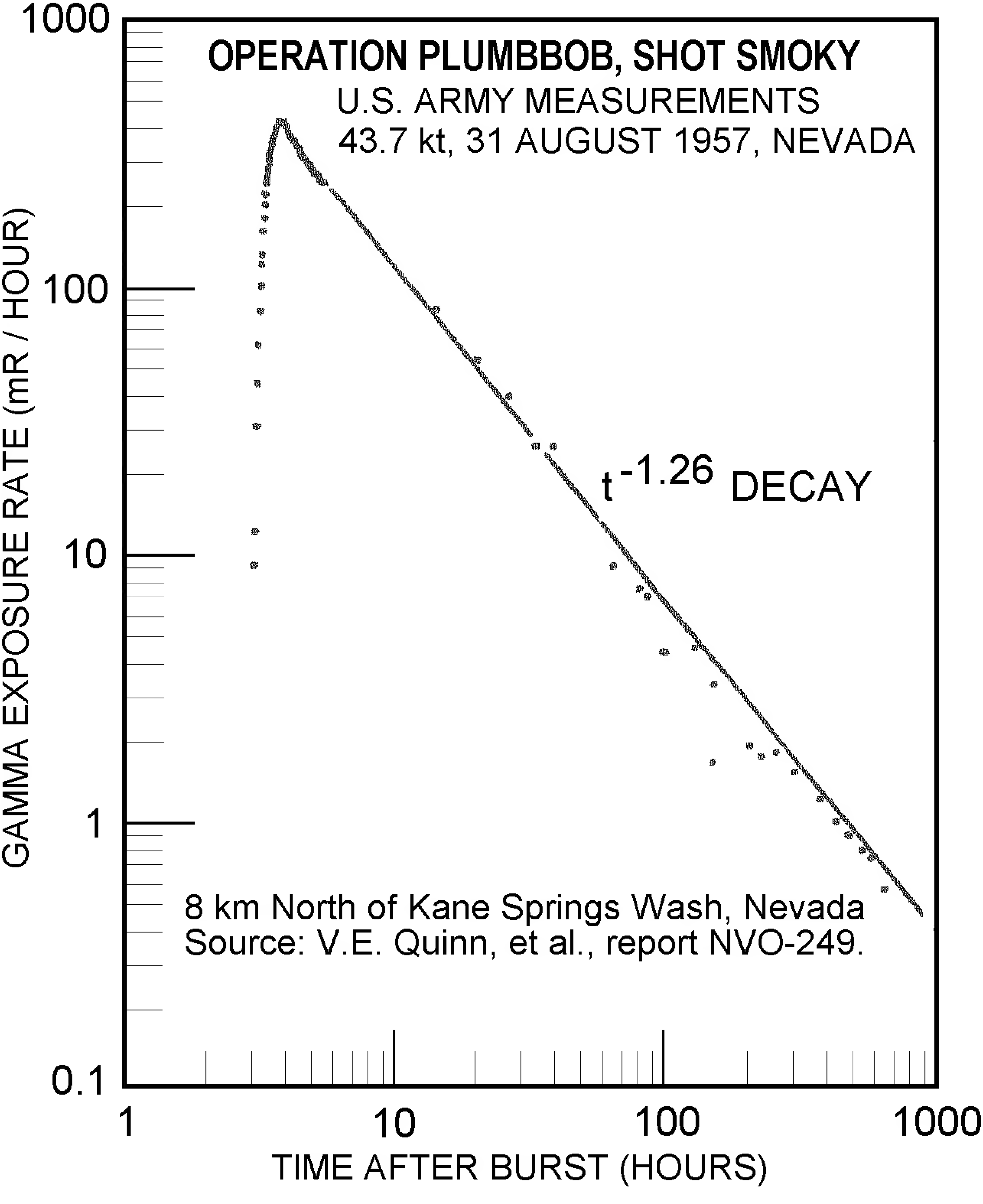


OPERATION CASTLE, 1954
KOON, 0.11 Mt
BRAVO, 14.8 Mt
UNION, 6.9 Mt
ROMEO, 11 Mt
Source: Roy D. Maxwell, et al., AFSWP-978 (1955), p. 45 Secret - Restricted Data
RELATIVE GAMMA DECAY RATES
TIME AFTER BURST (DAYS)
100
10
1
0.1
0.01
0.1
1
10
100
1000



OPERATION CASTLE, SHOT BRAVO, 1 MARCH 1954
14.8 Mt
STORM
OPERATION REDWING (FALLOUT FROM SHOT ZUNI)
OPERATION HARDTACK (FINAL BIKINI ATOLL TESTS)
Source: Edward E. Held, UWFL-91 (1965)
p. 9: "the reduction of gamma dose rates to ... half the predicted levels in 1959-63 probably reflects the downward movement ... in the soil."
RONGELAP ISLAND, RONGELAP ATOLL
YEARS
- NATURAL BACKGROUND RADIATION -
1 2 3 4 5 7 9
GAMMA EXPOSURE RATE (MILLIROENTGENS PER HOUR)
1000
100
10
1
0.1
0.01
1
10
100
1000
10,000
TIME AFTER BURST (DAYS)


OPERATION REDWING, BIKINI, 1956
Source: F.D. Jennings, Operation Redwing, Project 2.62a, report WT-1316.
Secret - Restricted Data.
RELATIVE GAMMA EXPOSURE DECAY RATES
TIME AFTER BURST (HOURS)
100
10
1
10
20
50
100
200
ZUNI
15% FISSION
NAVAJO
5% FISSION
TEWA
87% FISSION
FLATHEAD
73% FISSION
SHOT
TOTAL YIELD
ZUNI
3.53 Mt
NAVAJO
4.5 Mt
TEWA
5.01 Mt
FLATHEAD
0.365 Mt



OPERATION PLUMBBOB, SHOT SMOKY
U.S. ARMY MEASUREMENTS
43.7 kt, 31 AUGUST 1957, NEVADA
$t^{-1.26}$ DECAY
8 km North of Kane Springs Wash, Nevada
Source: V.E. Quinn, et al., report NVO-249.
GAMMA EXPOSURE RATE (mR / HOUR)
TIME AFTER BURST (HOURS)
1000
100
10
1
0.1
1
10
100
1000

C00012335

CENTRAL INTELLIGENCE AGENCY
WASHINGTON 25, D. C.

CIA 12 March 1962

12 MAR 1962

MEMORANDUM FOR: The Director of Central Intelligence

SUBJECT : MILITARY THOUGHT: "Some Factors Affecting the Planning of a Modern Offensive Operation", by Colonel-General Ye. Ivanov

1. Enclosed is a verbatim translation of an article which appeared in the TOP SECRET Special Collection of Articles of the Journal "Military Thought" ("Voyennaya Mysl") published by the Ministry of Defense, USSR, and distributed down to the level of Army Commander.

2. In the interests of protecting our source, this material should be handled on a need-to-know basis within your office. Requests for extra copies of this report or for utilization of any part of this document in any other form should be addressed to the originating office.

Richard Helms

Richard Helms
Deputy Director (Plans)

Following is a verbatim translation of an article titled "Some Factors Affecting the Planning of a Modern Offensive Operation", written by Colonel-General Ye. Ivanov.

This article appeared in the 1960 Second Issue of a special version of Voyennaya Mysl (Military Thought) which is classified TOP SECRET by the Soviets and is issued irregularly.

* * *

Weakening the nuclear strength of an opposing grouping of the enemy and depriving him of his capability to use nuclear weapons is one of the most important tasks, whose correct solution ensures the success of the offensive operation as a whole.

* * *

The mass utilization of nuclear weapons in short periods of time is the only way to achieve decisive destruction of the fire power of an opposing enemy grouping, destruction of his main nuclear/missile and aviation means, and also disruption of the control of troops and the disorganization of work of the rear services.

S E C R E T

Extracts from Khrushchev's letter to Kennedy, 26 October 1962 (Catalogue ref: PREM 11/3691)

QUOTE

Dear Mr. President:

I have received your letter of October 25. From your letter, I got the feeling that you have some understanding of the situation which has developed and (some) sense of responsibility. I value this.

Now we have already publicly exchanged our evaluations of the events around Cuba and each of us has set forth his explanation and his understanding of these events. Consequently, I would judge that, apparently, a continuation of an exchange of opinions at such a distance, even in the form of secret letters, will hardly add anything to that which one side has already said to the other.

I think you will understand me correctly if you are really concerned about the welfare of the world. Everyone needs peace: Both capitalists, if they have not lost their reason, and still more, Communists, people who know how to value not only their own lives but, more than anything, the lives of the people. We, Communists, are against all wars between states in general and have been defending the cause of peace since we came into the world. We have always regarded war as a calamity, and not as a game nor as a means for the attainment of definite goals, nor, all the more, as a goal in itself. Our goals are clear, and the means to attain them is labor. War is our enemy and a calamity for all the peoples.

It is thus that we, Soviet people, and, together with us, other peoples as well, understand the questions of war and peace. I can, in any case, firmly say this for the peoples of the Socialist countries, as well as for all progressive people who want peace, happiness, and friendship among peoples.

I see, Mr. President, that you too are not devoid of a sense of anxiety for the fate of the world, of understanding, and of what war entails. What would a war give you? You are threatening us with war. But you well know that the very least which you would receive in reply would be that you would experience the same consequences as those which you sent us. And that must be clear to us, people invested with authority, trust, and responsibility. We must not succumb to intoxication and petty passions, regardless of whether elections are impending in this or that country, or not impending. These are all transient things, but if indeed war should break out, then it would not be in our power to stop it, for such is the logic of war. I have

participated in two wars and know that war ends when it has rolled through cities and villages, everywhere sowing death and destruction.

In the name of the Soviet Government and the Soviet people, I assure you that your conclusions regarding offensive weapons on Cuba are groundless. It is apparent from what you have written me that our conceptions are different on this score, or rather, we have different estimates of these or those military means. Indeed, in reality, the same forms of weapons can have different interpretations.

You are a military man and, I hope, will understand me. Let us take for example a simple cannon. What sort of means is this: offensive or defensive? A cannon is a defensive means if it is set up to defend boundaries or a fortified area. But if one concentrates artillery, and adds to it the necessary number of troops. Then the same cannons do become an offensive means, because they prepare and clear the way for infantry to attack. The same happens with missile - nuclear weapons as well, with any type of this weapon.

You are mistaken if you think that any of our means on Cuba are offensive. However, let us not quarrel now. It is apparent that I will not be able to convince you of this. But I say to you: You, Mr. President, are a military man and should understand: Can one attack, if one has on one's territory even an enormous quantity of missiles of various effective radiuses and various power, but using only these means? These missiles are a means of extermination and destruction. But one cannot attack with these missiles, even nuclear missiles of a power of 100 megatons because only people, troops, can attack. Without people, any means however powerful cannot be offensive.

Armaments bring only disasters. When one accumulates them, this damages the economy, and if one puts them to use, then they destroy people on both sides. Consequently, only a madman can believe that armaments are the principal means in the life of society. No, they are an enforced loss of human energy, and what is more are for the destruction of man himself. If people do not show wisdom, then in the final analysis they will come to a clash, like blind moles, and then reciprocal extermination will begin.

Let us therefore show statesmanlike wisdom. I propose: We, for our part, will declare that our ships, bound for Cuba, will not carry any kind of armaments. You would declare that the United States will not invade Cuba with its forces and will not support any sort of forces which might intend to carry out an invasion of Cuba. Then the necessity for the presence of our military specialists in Cuba would disappear.

'PEACE' OF THE DEAD

1986 CND "mole"
(infiltrator) Paul
Mercer exposed
USSR propaganda

Paul Mercer

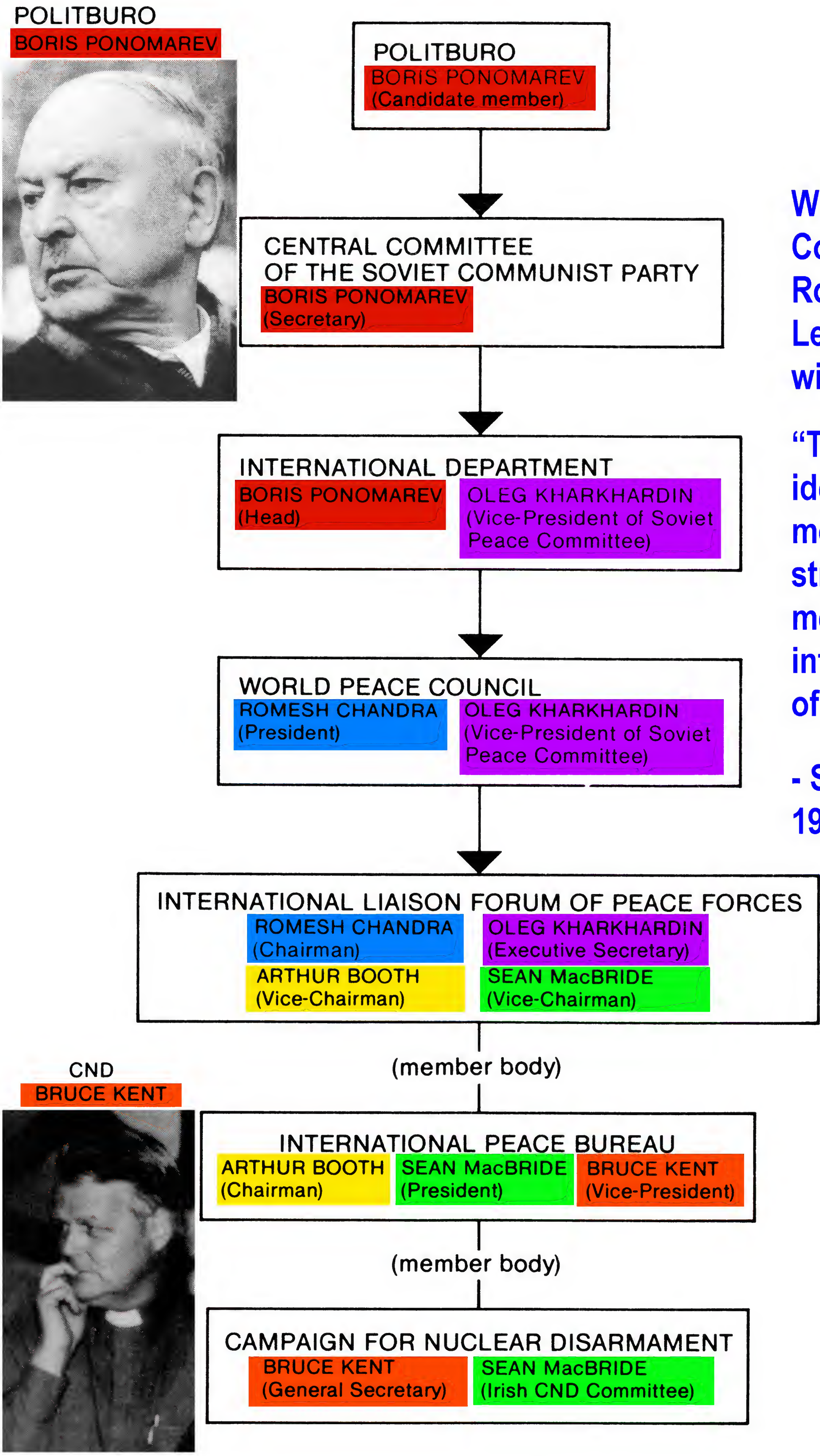
Foreword by Lord Chalfont, OBE, MC, PC

"I personally need no lessons on how to combat 'anti-Sovietism' in the peace movement from armchair peace campaigners. The consistent stand of CND for unilateral nuclear disarmament and withdrawal from NATO has been won by working as Communists in a principled non-sectarian way."—CND Vice-President, John Cox *Morning Star*, 8 January 1985

Paul Mercer, who graduated from Nottingham University in 1982, is a political research consultant and author of several specialist books on military aviation.

The author (*left*) with one of his 'sources', Mgr Bruce Kent—former General Secretary of the Campaign for Nuclear Disarmament.

"I don't condemn the IRA bombings in public—I explain that they are a direct response to British policy—in some situations it's not useful to preach pacifism."—CND Council Member, Pat Arrowsmith *Socialist Challenge*, 4 June 1982



World Peace Council President Romesh Chandra, Lenin Peace Prize winner:

"There is a wrong idea that détente means lessening the struggle ... détente means the intensification of the struggle ..."

- Sunday Chronicle, 19 December 1976

One of the CND's many links with the World Peace Council in 1983

Sean MacBride is a former IRA Commander awarded a Lenin Peace Prize and a Nobel

Boris Ponomarev, Politburo

(b 1905, Red Army 1919, Central C. 1956, Politburo 1972)

Head of the International Department, CCCP

Propagandarist inventor of détente appeasement

Boris Ponomarev was author of the books "The Great Vital Force of Leninism" and "The Liberation Movement", both Russian propaganda publications sent directly by the International Department of the Politburo to the British National Union of Teachers (NUT) as direct infiltration of Britain's schools. (Sources: John Izbicki, Daily Telegraph, 18 May 1981; Pincher, "The Secret Offensive") Result: NUT's "Teachers for Peace" anti-nuclear lobby for pro-détente school fiction, like "Z for Zachariah".

HOW MOTHERS LIKE ME ARE DRIVEN TO JOIN THE BIG PEACE DEMOS

The Cruise missile . . . target for CND fairytales. And (right) a concerned mother on the march.

This CND blackmail at our school gates . . .

by ANN LESLIE

SO were you there on October 22 ? Were you one of the huge crowd of 250,000 demonstrators thronging Hyde Park ?

And if you were not there, did you feel a little bit guilty about it ? Did some of that magnificent pre-rally CND propaganda get to you ?

Because it was indeed powerful. propaganda. On Friday morning, the day before the demos, I and other mothers were delivering our tiny sons and daughters to their North London primary school.

This humdrum, happy, chattering little scene in the sunshine was briefly overshadowed by a sudden glimpse of apocalyptic terror in the form of two leaflets handed out to us at the gates.

Horrors

The first said : 'October 22. Where will you be ?' The second, from the Camden Labour Party, told us why we should be there on Saturday. Cruise missiles, due to be installed in December, will 'make nuclear war more likely. . . .'

And just in case we mothers were to preoccupied juggling with push-chairs and shopping-bags to understand the implications of that, the leaflets told us what would happen if a one megaton bomb was exploded over Trafalgar Square.

We live in the 'area north of London Zoo up to Hampstead Heath' and that would mean, among other horrors, '50 per cent. dead from blast (ruptured guts, crushed bones).'

It didn't of course mention that the Soviets already have over 350 SS20s installed, each with three warheads, two-thirds of which are targeted on Western Europe. Information like that might 'confuse' us mothers outside the school gates.

Nor did it mention that most members of unofficial peace groups in Eastern Europe — those not controlled for propaganda purposes by the Soviet authorities — are bitterly opposed to the unilateralist and neutralist ideas of CND.

These Eastern Europeans know the realities of Soviet power, and they know that the West can only hope to succeed in disarmament negotiations if it negotiates from a position of strength.

The message handed out at the school gates had to be kept 'unconfused' by such 'irrelevant' facts.

And so, yes, those leaflets did have a powerful emotional kick. As I watched my adored little five-year-old cheerfully hurrying into class with her best friend, I felt a sudden lurch in my stomach.

Those two merry little souls, millions of innocents like them — 'ruptured guts, crushed bones'. Please God, no !

Declined

So why didn't I join that march on Saturday ? Don't I care ?

Well, it so happens that I was there—not as a demonstrator but as an observer. I was making a film report for Channel 4 on the demonstration which CND now claims is 'proof' that the peace movement has not lost its battle.

I had assumed that everyone in that crowd on Saturday actually knew what they were demonstrating about. But did they ?

Oh sure, they were, as everyone told me earnestly, demonstrating 'in favour of peace and against nuclear war'. Well, you'd have to be criminally insane not to be in favour of peace and against nuclear war. So let's try to take it beyond the infants' class level.

No use pointing out that public opinion as expressed by the people of Hungary, East Germany, Czechoslovakia, Poland and Afghanistan has only influenced the Kremlin into greater spasms of repression and cruelty.

Destroy

Presumably most of those at the demonstration were convinced by CND's propaganda

Nor is there any illusion at NATO or SHAPE headquarters (where last week I sat through many discussions with men with titles like Head of Nuclear Planning) that America could fight a limited nuclear war in Europe.

As General Rogers, the American Supreme Allied Commander, Europe, said : 'The Soviets have said that any American weapon system being fired at Soviet soil will be cause for her to attack the United States with strategic weapons.'

How many of the people in that crowd of 250,000 have been told any of this by CND ? Very few.

Alas, some of them didn't even seem to know the difference between 'unilateralist' and 'multilateralist'. One nice, earnest young man told me he was there because he was a 'multilateralist'.

Outbreak

But this, I pointed out, was a demonstration in favour of 'unilateralism'. His response was a look of utter bafflement.

Many in the crowd used the demonstration to promote a whole variety of separate causes. Like the seller of the Hard-Left newspaper who told me we must 'defend the Soviet Union against Western imperialism.'

Like those who wanted solar heating in homes. Like the Hare Krishna people who said that meat-eating was the cause of nuclear war.

And like the Greenham women, who were collecting money to finance a 'permanent' peace headquarters.

Not so long ago, they were telling me that the arrival of the first Cruise missile would mean the outbreak of nuclear Armageddon. Since the end of the world is nigh in a few weeks, it seemed odd, to say the least, to ask for money to set up a 'permanent' headquarters.

So all of you who might have felt a twinge of guilt about not 'being there on October 22' — forget it. The majority of those who were there were well-meaning, hopelessly muddled, easily exploited people

1983 Daily Mail

This battle for your child's mind

The fact is that most parents, throughout the country, would be horrified if they realised how, even in the basic routine subjects, such as English, History and Science, their sons and daughters are being indoctrinated.

Take a look at the methods employed in sample lessons in at least one school:

An English lesson is based on how the language of the nuclear age is used by the media to condition ordinary people into accepting Cruise missiles.

Then the teacher takes a headline from the sports pages: 'Hammers massacre Coventry in five-goal blitz.' He uses it as the starting point for a discussion which moves on to deplore the way newspapers and TV glory in war and distort the views of those who believe in peace.

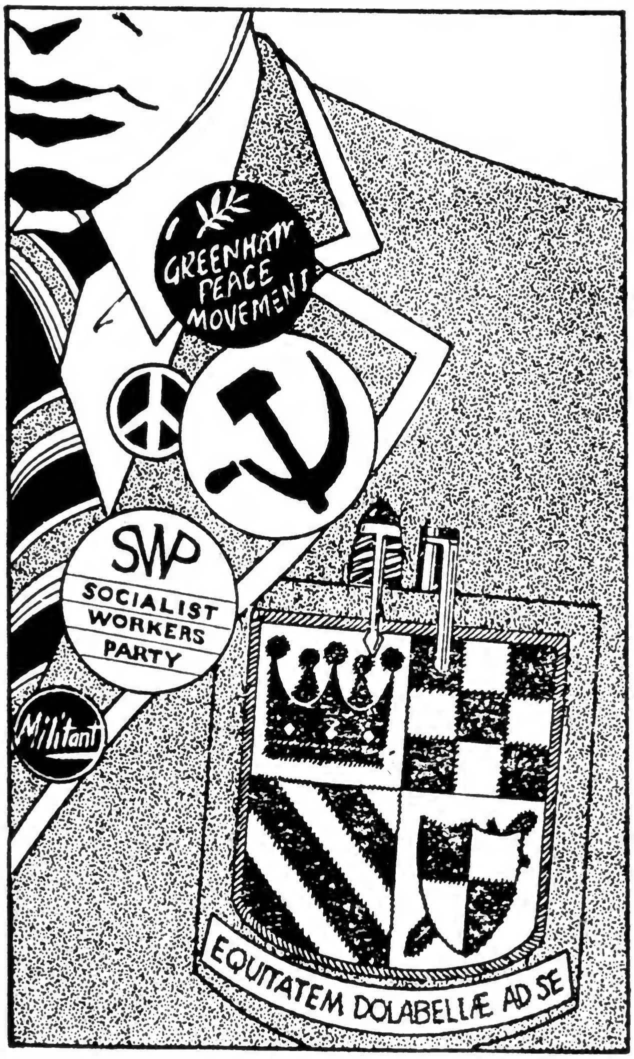
Science, before lunch, is easier. The Physics master, in defiance of a request from the Minister of Education, gives the pupils the full benefit of his personal conviction that American possession of a nuclear arsenal is a one-way suicide trip for mankind.

History, in the afternoon, is a study, through books supplied to the school by Novosti, the Soviet Press agency, of Russia's peaceloving intentions over the last 30 years, compared with Western war-mongering.

A fantasy? Not the sort of school you would dream of letting your child attend?

No It is fact. And you might soon have no choice but to send your child to such a school.

For there is at least one comprehensive school in Britain where each one of these sample lessons—or ones similar—has already taken place. And there are at least a dozen major local



by Rodney Tyler

In Britain's biggest teachers' union, the National Union of Teachers, more than 10 per cent. of delegates at the annual conferences come from just one of the extreme Left-Wing groups operating within the educational system.

But what he feared most of all was the attempt by the notorious Inner London Education Authority to foist on him those that were politically in line with its far-left leadership.

This school year he will be ordered to give more status to

released for special courses in how to combat racism.

Another London head described a visit from one of the proliferating 'advisers' who demanded to know why Irish politics, history, literature, and music were not being taught to the Irish children in his school.

The visitor accused him of 'not co-operating' when he pointed out that he had 30 different nationalities in the school and if he discriminated in favour of one minority he would have to favour them all.

But he sees as far more sinister the question he and ILEA's 170 comprehensive heads were forced to answer recently: 'Do you recognise the role of the "hidden Curriculum" in political education?'

He told me: 'It was rather like being asked if I had stopped beating my wife. If I said yes it would have meant that I was secretly indoctrinating my children, if I said no it meant I was refusing to do so. Either way I would be open to attack.'

The hidden curriculum is another way, in Left-Wing eyes, of influencing children. Put bluntly, it means taking every opportunity as it arises in normal lessons to put across your political message.

It is this sinister move, which ILEA—Britain's biggest authority—is poised to introduce. Thus, both overtly and covertly they plan a massive programme of indoctrination.

Printed advice on how to get rid of uncooperative heads which circulates secretly among some of these groups includes such gems as:

- Hold sudden meetings at the most difficult times for the head and his staff.
- Prolong meetings unnecessarily and harass officials of the Board into resignation — then put your own people into their positions

CND: IS IT ALL A RUSSIAN CON TRICK?

By MARJORY DAVIDSON

THE 19 Very Important Visitors were welcomed to Moscow in the style of Heads of State.

Police escorted their motorcade as it swept through red lights on the way from Sheremitovo Airport to a downtown hotel.

Moscow's making fools of our ban the bomb brigade

Visits to the Bolshoi Ballet, the old Czarist capital, Leningrad and the fabled cities of Tashkent and Samarkand were on the programme.

And it was red carpet treatment all the way.

The cost of this 10 day jaunt? Nothing—save the £190 cut-price air fare from London.

Who were the lucky 19? Not pop stars, or soccer players or even astronauts.

They were members of the Campaign for Nuclear Disarmament and fellow sympathisers. Lord Brockway, co-chairman of the World Disarmament Campaign, led the party which included respected pacifists Dr Malcolm Dando, of Bradford University's School of Peace Studies, Richard Keeble, editor of The Teacher, and Father Owen Hardwicke, of Pay Christi, the Roman Catholic Disarmament lobby.

They had come to Moscow to talk peace.

But like the hundreds of thousands of ban-the-bomb marchers throughout Europe, they were and are, tragically, just dupes.

They are part of a campaign that is orchestrated and financed by the Soviet Union with the direct purpose of weakening the West, her resolve and her strength, while Russia continues to build up the most fearsome military machine in history.

Take that starry-eyed journey last March. The Russians quickly showed their visitors that they wanted others to talk about peace. They want others to disarm.

The naive band of travellers were campaigning for Britain to scrap all nuclear weapons. When they hesitantly asked the Kremlin to make a possible ten per cent reduction in its nuclear arsenal, the reply was a brutal "Niet."

In Britain, the ban-the-bomb campaign is booming. Membership has increased from 3,000 to 37,000 in 18 months and includes many idealistic young people.

Last October, more than 1[illegible]0,000 people from all over Britain attended the biggest demonstration in London since the heady days of the Sixties.

Brezhnev flew from Moscow to meet the 1,000 Soviet-subsidised delegates in Sofia.

Labour MPs present included Roy Hughes (Newport), James Lamond (Oldham East), Andrew Bennett (Stockport North), William Wilson (Coventry SE) and Alf Lomas (Euro MP London NE).

Alex Kitson, executive officer of the Transport and General Workers' Union, was also among the guests.

In Britain, as CND membership has grown, a Left-wing takeover has emer[illegible]he top.

Idealists have been replaced by militants with potent Euro-Communist connections.

They seek a power base in Britain. They aim to get it by exploiting the fear and horror felt by decent men and women at the idea of nuclear war.

They have formed special sections — Youth CND and Christian CND —to extend their sphere of influence.

They are especially active in trying to persuade trade unions to affiliate to CND.

These are the facts to remember when [illegible] you are impressed [illegible] lovers on the [illegible] Moscow-style.

LEFTIES WHO RUN PEACE CAMPAIGN

September 30, 1938 peace promise:

We, the German Führer and Chancellor and the British Prime Minister, have had a further meeting today and are agreed in recognising that the question of Anglo-German relations is of the first importance for the two countries and for Europe.

We regard the agreement signed last night and the Anglo-German Naval Agreement as symbolic of the desire of our two peoples never to go to war with one another again.

We are resolved that the method of consultation shall be the method adopted to deal with any other questions that may concern our two countries, and we are determined to continue our efforts to remove possible sources of difference and thus to contribute to assure the peace of Europe.

A Hitler

Neville Chamberlain

September 30. 1938.

$5.95

AMERICA IS IN DANGER

by General Curtis E. LeMay

"America is in danger. . . . We find ourselves in a purely defensive role, unable to make our will felt even in a conflict with a backward jungle country. . . . Our strategic nuclear superiority has given us much diplomatic strength in the past. Do we still have that strength? Do we have enough faith in our general war capability to prevail in a crisis? I think not. That is why America is in grave danger."

In this book Gen. Curtis E. LeMay—former member of the Joint Chiefs and first commander of the Strategic Air Command—closely analyzes and challenges the government's claim to have greatly strengthened our military position. He finds minor improvements in conventional forces, but actual reductions in nuclear capability and an over-all decline compared to Soviet forces.

General LeMay, while stressing the paramount need for civil control of the military, attacks civilian manipulation of technical military decisions as unprecedented and disastrous.

(continued on back flap)

(continued from front flap)

Assessing the strategic situation, General LeMay argues that our former policy of overwhelming nuclear superiority proved itself during the crises in Berlin, Taiwan, and Cuba, and produced twenty years of relative peace. Yet the current Administration has opted for a new and untested posture that permits, even encourages parity with Russia.

According to the author, we have fostered disunity in NATO—first, by failing to sign a German peace treaty (General LeMay proposes what he believes to be a workable solution), and second, by our nonproliferation policy, which, combined with complete dependence on massive retaliation for deterrence, has caused European leaders to question our nuclear guarantees.

While approving the decision to produce a thin-line antiballistic missile defense, General LeMay pleads for an urgent upgrading of this program, pointing to Russia's rapidly growing ABM force.

Finally, General LeMay analyzes our limited war strategy with particular reference to Vietnam and proposes immediate steps to insure not simply a military victory but a stable political and social solution.

As a man who has devoted his life to America's security, the author strongly believes that present defense policies endanger our ability to survive. In this urgent and thoughtful book General LeMay not only criticizes; he offers alternate solutions to bolster our strength and preserve peace.

FUNK & WAGNALLS
NEW YORK

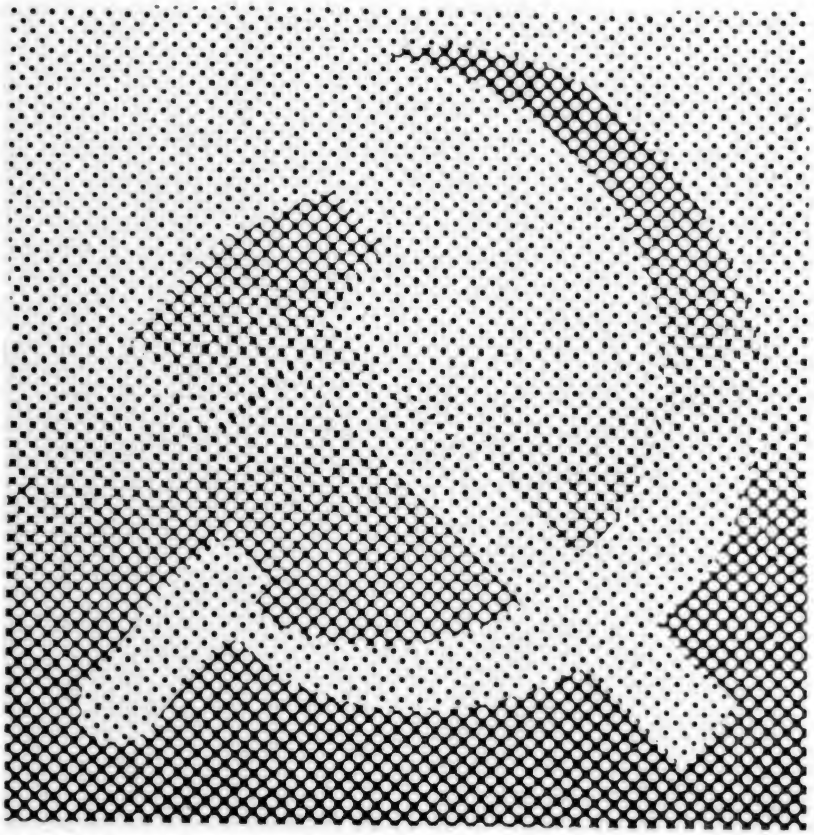
Jacket design: Paul Bacon Studio

Spencer Weart, Never at War: Why Democracies Will Not Fight One Another, Yale University Press, 1998:

"This idea had been developed by 1785 ... A world where every state was a democracy, [Immanuel Kant] wrote, would be a world of perpetual peace. Free peoples ... will make war only when driven to it by tyrants. ... there have been no wars between well-established democracies. ... the absence of wars between well-established democracies [has a probability of being coincidence] less than one chance in a thousand. ... robust statistics ... When toleration of dissent has persisted for three years ... a new republic [is] 'well established.' ... [Diplomatic pacifism made war by the 'appeasement trap' of trying to 'accommodate a tyrant.'] ... the tyrant concluded that he could safely make an aggressive response ... [thus] negotiating styles are not based strictly on sound reasoning."

Military Psychology

A Soviet View



Edited by:
V.V. SHELYAG
A.D. GLOTOCHKIN
K.K. PLATONOV

Moscow 1972

TRANSLATED AND PUBLISHED
UNDER THE AUSPICES OF
THE UNITED STATES AIR FORCE

ВОЕННАЯ ПСИХОЛОГИЯ

УЧЕБНИК
ДЛЯ ВЫСШИХ ВОЕННО-ПОЛИТИЧЕСКИХ
УЧИЛИЩ
СОВЕТСКОЙ АРМИИ
И ВОЕННО-МОРСКОГО ФЛОТА

Под редакцией
В. В. ШЕЛЯГА,
А. Д. ГЛОТОЧКИНА,
К. К. ПЛАТОНОВА

Ордена Трудового Красного Знамени
ВОЕННОЕ ИЗДАТЕЛЬСТВО
МИНИСТЕРСТВА ОБОРОНЫ СССР
МОСКВА—1972

Chapter 28. The Psychology of Agitation and Propaganda Activity

"Propaganda" and "agitation" are words of Latin origin. To propagandize means to disseminate knowledge, ideas, views, and theories, while to agitate means to stir up definite aspirations and arouse people to action.

However, the essence of our Party and Leninist propaganda is significantly deeper. It must not only disseminate and transmit revolutionary ideas, but also make them the convictions of the people. By agitation, we mean a direct appeal and ability to direct the energy and will of the people to struggle for carrying out the ideas of communism in practice.

A scientific explanation of the essence of communist propaganda and agitation as well as their unity and differences was provided by V. I. Lenin.

V. I. Lenin in his work *Chto Delat'?* (What Is to be Done?), from the example of explaining the question of unemployment to the masses, showed the difference between propaganda and agitation: ". . . The propagandist, if he takes, for example, the same question of unemployment, should explain the capitalist nature of the crises, show the cause of their inevitability in modern society, sketch the necessity of transforming it into a socialist society, and so forth. In a word, he should provide 'many ideas,' or so many ideas that all these ideas at once, in their aggregate, will be assimilated by only a few (comparatively) persons. But an agitator, in speaking on the same question, takes the most outstanding example or one which is best known to his listeners . . ."

"The art of any propagandist or agitator," stressed V. I. Lenin, "is in influencing a given audience in the best way, and making a certain truth for the audience as convincing as possible, as easy to assimilate as possible, and as visibly and strongly memorable as possible." V. I. Lenin, *Poln. sobr. soch.*, Vol 21, p 21.

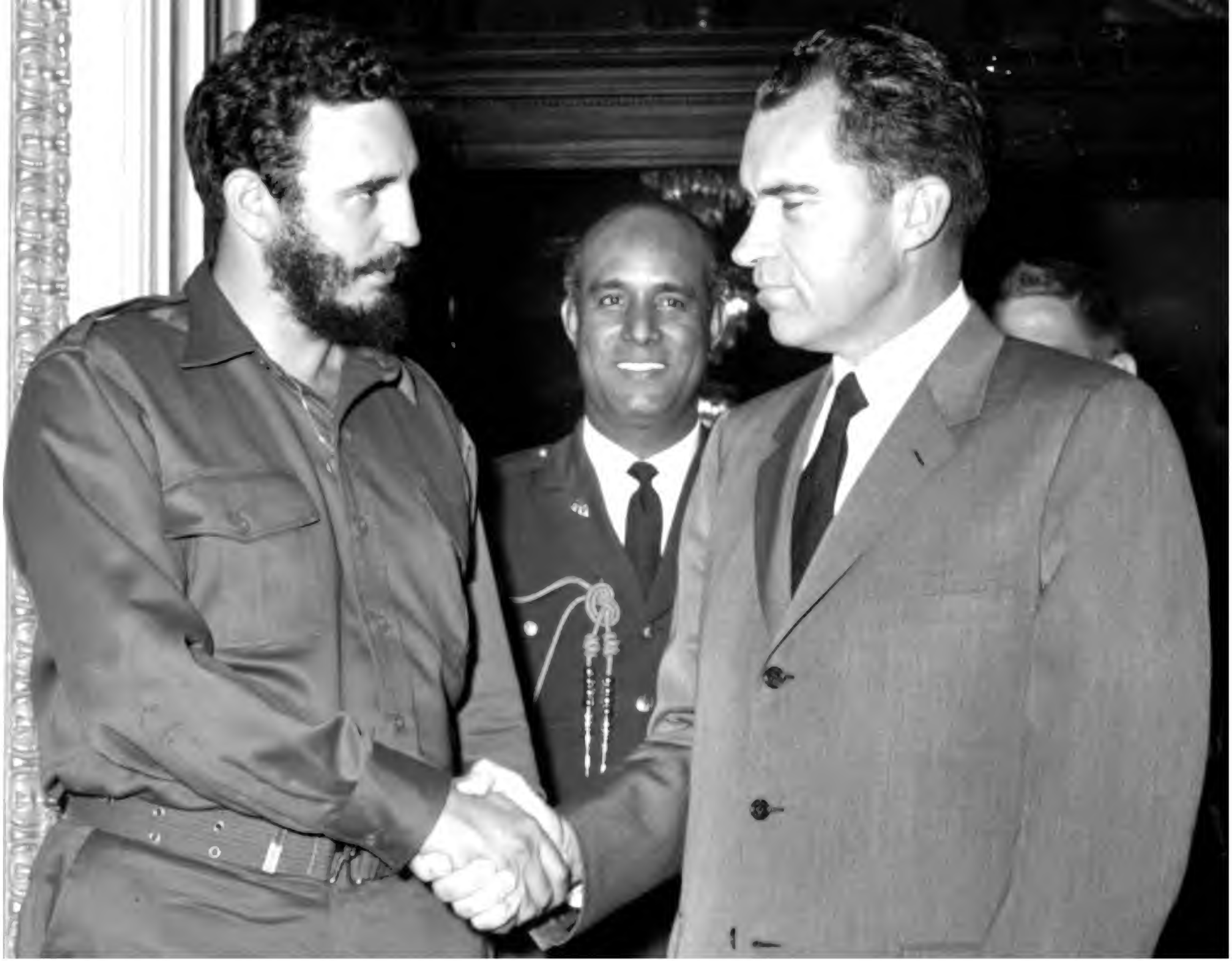
Convincingness is achieved by the propagandist's profound knowledge of theoretical problems and practical questions which he explains. A propagandist's speech is notable in its vivid exposition of the basic thought and main idea, reinforced with rich factual material, and enrichment of the listeners with new knowledge.

In propaganda, it is advisable to limit oneself in using obvious and reliable judgments, for an abundance of them frees the listener from the need to think, and teaches dogmatism.

Fourth, the words of an agitator will be convincing if and when these words are theoretically argued with sufficient profundity. The talk of an agitator is not only a conversation on current subjects, but also an explanation of a certain idea or theory. Only profound understanding of this idea by the masses will raise their revolutionary activeness which the agitator directs by his appeals in the appropriate manner. For this reason, a true agitator is a politically intelligent and ideologically convinced fighter for the Party. The best agitators are political workers, commanders, engineers, progressive-minded personnel, soldiers, and sergeants whose words are an authority for comrades.

Fifth, agitation cannot be effective if it is not capable of becoming a means for an emotional effect upon the listeners. The agitator influences the audience not only by his words, but by the entire range of his human personality, how he proves the theoretical theses, and by his tone and demeanor. The vivid and lively language of an agitator, and the most successful and intelligent form found by him for expressing an idea are important factors helping to carry out the agitation passionately and convincingly.

The observance of the listed conditions, which provide for the effectiveness of an agitator's talk, requires from him certain qualities, profound knowledge, high personal culture, combat and methodological preparation, ability to think logically, as well as the capability to come into contact with different people.



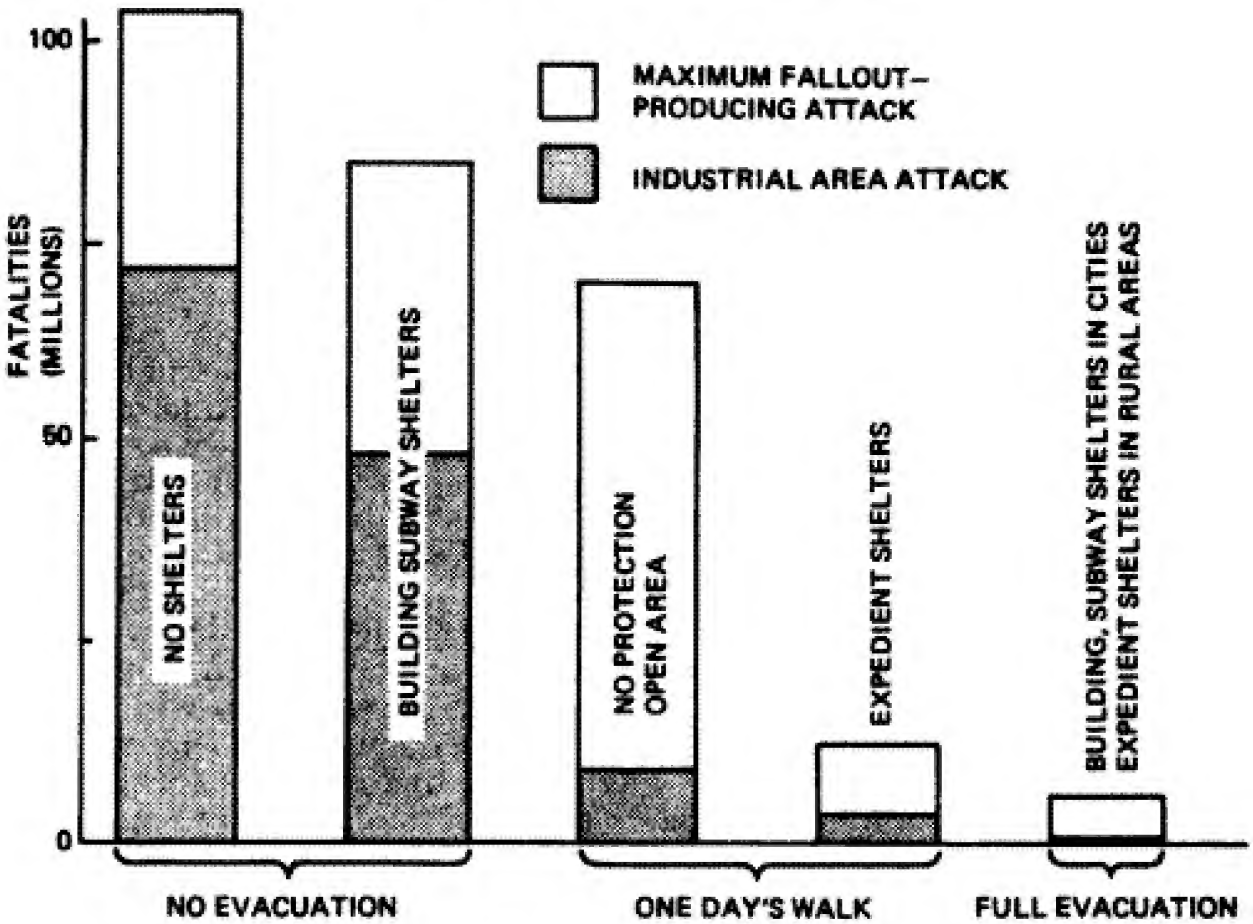
April 21, 1959 Cuban President Fidel Castro and Vice President Nixon

INDUSTRIAL PREPAREDNESS AND NUCLEAR WAR SURVIVAL

WEDNESDAY, NOVEMBER 17, 1976

U.S. CONGRESS,
JOINT COMMITTEE ON DEFENSE PRODUCTION,
Washington, D.C.

MR. THOMAS K. JONES



Soviet population fatalities (surviving U.S. Strategic Forces).

Robert Scheer

WITH ENOUGH SHOVELS: Reagan, Bush & Nuclear War

"Dig a hole, cover it with a couple of doors and then throw three feet of dirt on top... It's the dirt that does it... if there are enough shovels to go around, everybody's going to make it."

—T. K. Jones, Deputy Under Secretary of Defense for Strategic and Theater Nuclear Forces

"President Ronald Reagan had been in office less than a year when he approved a secret plan for the United States to prevail in a protracted nuclear war. This secret plan, outlined in a so-called National Security Decision Document, committed the United States for the first time to the idea that a global nuclear war can be won."

With these words Robert Scheer, the distinguished national reporter for the *Los Angeles Times*, begins this astonishing revelation of how a handful of Cold War ideologues—led by the President himself—have reversed the longstanding American assumption that nuclear war means mutual suicide.

Robert Scheer's aim in *With Enough Shovels* is to expose the deadly course on which we are now embarked, a course that categorically rejects the strategic assumptions that prevailed from Presidents Eisenhower through Carter and that sustained the Nixon-Kissinger program of détente—a program which our current leaders call "appeasement."

Leon Gouré

WAR SURVIVAL IN SOVIET STRATEGY

USSR
CIVIL DEFENSE

With a Foreword by
AMBASSADOR FOY D. KOHLER

SECRET CIA report leaked to Reagan in 1979

integrated city and rural civil defense exercises. One exercise of this type occurred in 1975 at Lytkarino, a town of 40,000 people near Moscow and a probable relocation site for Muscovites. According to Soviet publications, thousands of people participated, communication and reconnaissance operations were conducted, and shelters were occupied by local workers. Another 1975 exercise, in Tul'skaya Oblast, involved the city of Kimovsk in Kimovskiy Rayon; this was known as an "integrated rayonal exercise." There may

LEON GOURÉ is a Professor of International Studies and Director of Soviet Studies at the Center for Advanced International Studies at the University of Miami. A graduate of New York University, Columbia University School of International Affairs and Russian Institute, and Georgetown University, he is the author of *Civil Defense in the Soviet Union, The Siege of Leningrad,* and *Soviet Civil Defense 1969-70*. He has also co-authored *Soviet Strategy for the Seventies: From Cold War to Peaceful Coexistence, The Role of Nuclear Forces in Current Soviet Strategy,* and *Soviet Penetration of Latin America* among others.

1st printing .... April 1976

2nd printing .... August 1976

Foreword

by Foy D. Kohler

Dr. Leon Gouré has devoted many years of study to Soviet civil defense and other war-survival policies and activities in the USSR. The area was one of his specialties while serving as a Senior Analyst for the RAND Corporation from 1951 to 1969, and he has continued his researches since joining the University of Miami in 1969 as Director of Soviet Studies and Professor in the Center for Advanced International Studies.

As a part of our work program for this larger undertaking, the Center has held a series of special conferences wherein we have subjected our methodology and research findings to critical review by outside experts, including authoritative academic and governmental specialists on Soviet affairs and high-ranking policy-action officers from Defense, State and other agencies directly concerned with U.S.-Soviet relations.

At two of these conferences, special attention has been given to the Soviet war-survival problem: One in June 1975 included an exploration of how war-survival capabilities fit into the Soviet appraisal of the present and future "correlation of world forces." The second, held in January 1976, included a thorough examination of the implications for U.S. security interests and U.S. policy choices of what Moscow is actually doing in the war-survival area.

Nearly all of the experts at our conference viewed the reasoning behind the overkill concept as "absurd." One cited as an example an article in the April 6, 1975 *Bulletin of the Atomic Scientists* in which the author argued that with its present stockpile of nuclear weapons the U.S. could destroy the world's population "twelve times over." The author's calculation was arrived at by multiplying the casualties per kiloton in Hiroshima and Nagasaki by the total number of kilotons in the U.S. nuclear arsenal and then dividing by the number of people living in the world. Such a calculation was characterized as completely misleading. Leaving aside such questions as how many U.S. weapons would survive a Soviet attack on this country and how many of the residue could be delivered on target, "it implies that means can be devised to collect the entire target population into the same density as existed in Hiroshima and Nagasaki and keep them in a completely unwarned and hence vulnerable posture. A statement of identical validity is that the world's inventory of artillery shells, small arms ammunition, or for that matter, kitchen knives or rocks can kill the human population several times over."

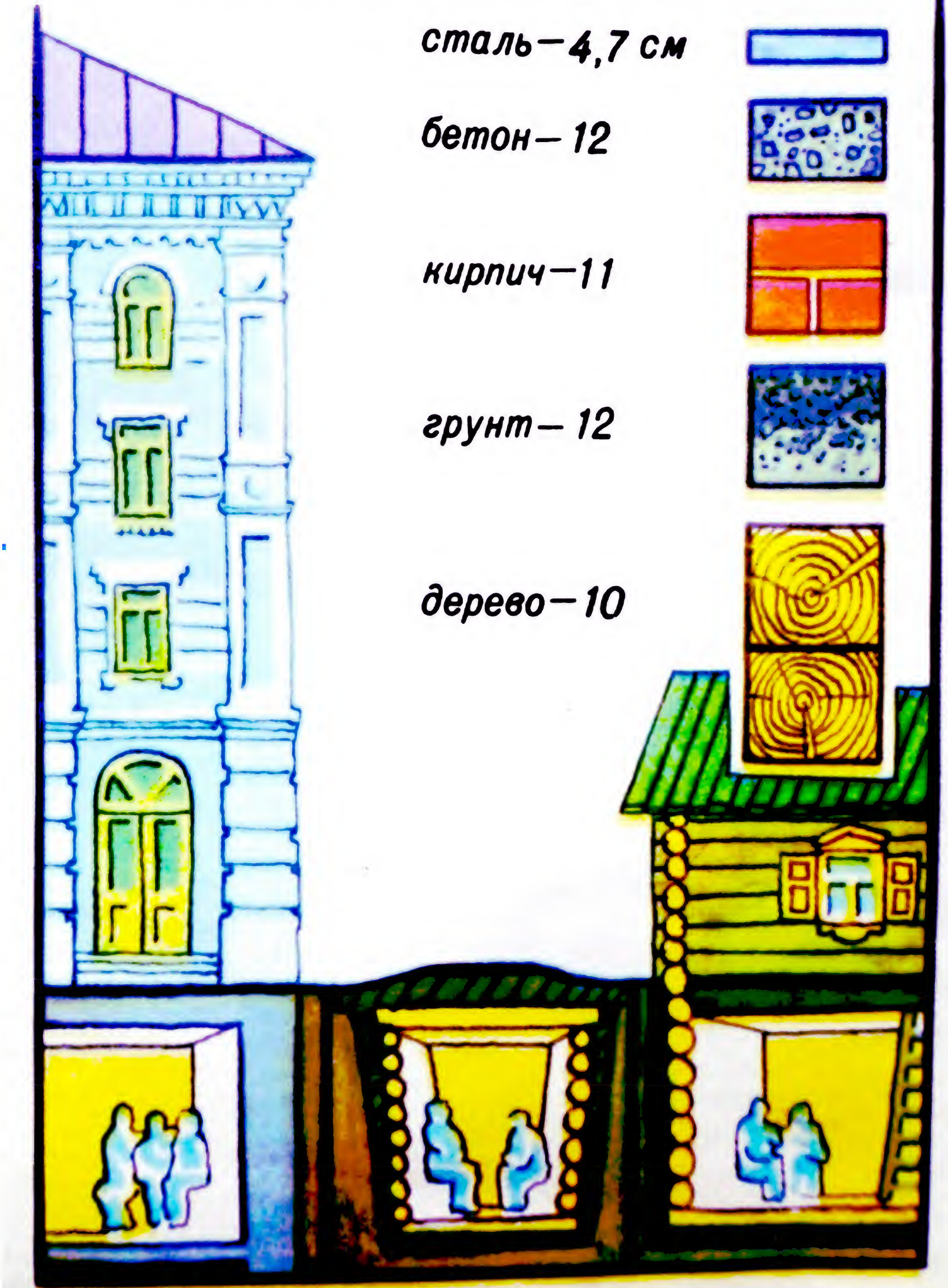
It was recalled that more than 10 billion pounds of TNT was dropped on Germany, Japan and Italy during World War II. This equalled more than 50 pounds for every man, woman and child in the three countries. Arithmetically considered, the result should have been the total annihilation of one and all of these. During the Vietnam War, more than 25 billion pounds of TNT were dumped on North and South Vietnam (15 billion by air and some 10 billion by other means) for an average of some 730 pounds for each of a total population of 34 million and an average of 3,000 pounds for each person in prime target areas; yet the U.S. was unable to kill enough people or to disrupt economic life, transportation and communications sufficiently to even avoid a humilitating defeat in the war.

The basic issue, it was agreed, is how Moscow intends to exploit the situation politically. The Soviet risk calculations and ability to use its military power for political purposes are already being increasingly influenced by Moscow's perceptions of asymmetries between the U.S. and Soviet war-survival versus assured destruction capabilities. According to Moscow's view, these asymmetries are of great strategic significance for making Soviet power credible as a deterrent and as an instrument of policy. Soviet spokesmen have given clear indication of their awareness of the lack of a war-survival program in the U.S. as well as of the vulnerability of the U.S. arising from the high degree of concentration of its population and industry in a few areas of the country. It is inevitable, therefore, that the Soviet leadership will perceive this asymmetry between the Soviet Union and the U.S. as altering the balance of forces in Moscow's favor, and as affecting the credibility of the respective strategic deterrence and war-fighting postures of the two countries.

In effect, with its growing war-survival capability, the Soviet Union could well conclude that the U.S. threat of "massive retaliation" has no credibility except as an act of sheer desperation. In crisis situations, this factor could decisively influence both sides' risk calculations and consequently their relative ability and willingness to hold a hard line. The Soviet Union could confront the U.S. with its ability to keep Soviet population and resource losses within acceptable limits, all the more so if it carries out the evacuation of its cities, as against the certainty of U.S. losses of 50 percent or more of its population and of a very large portion of its industry. This would place the U.S. at a great disadvantage in the management of the crisis and in its negotiations with the Soviet Union. Instead of a "balance of terror" which equally restrains both sides, the "terror" would be mainly on the part of the U.S. and, faced with the possibility of national "suicide," the public reaction to it would be likely to deprive the President of any flexibility in his policy choices in dealing with Moscow.

ЗАЩИТНЫЕ СВОЙСТВА МАТЕРИАЛОВ

Экспозиционную дозу радиации ослабляют вдвое материалы толщиной



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Interagency Intelligence Memorandum

CIA HISTORICAL REVIEW PROGRAM
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Soviet Civil Defense

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NIO IIM 76-041
November 1976

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— *Basement*—shelters created by adapting the basement areas of residential, government, and industrial structures, primarily for protection against fallout. (See Figure 12.)

— *Subways*—shelters provided by using the subway tunnels in major Soviet cities. The degree of protection against blast varies within subways, but all afford good protection against fallout. (See Figure 13.)

— *Expedient or hasty*—shelters built with materials readily available during the period immediately prior to a nuclear attack. (See Figure 14.)

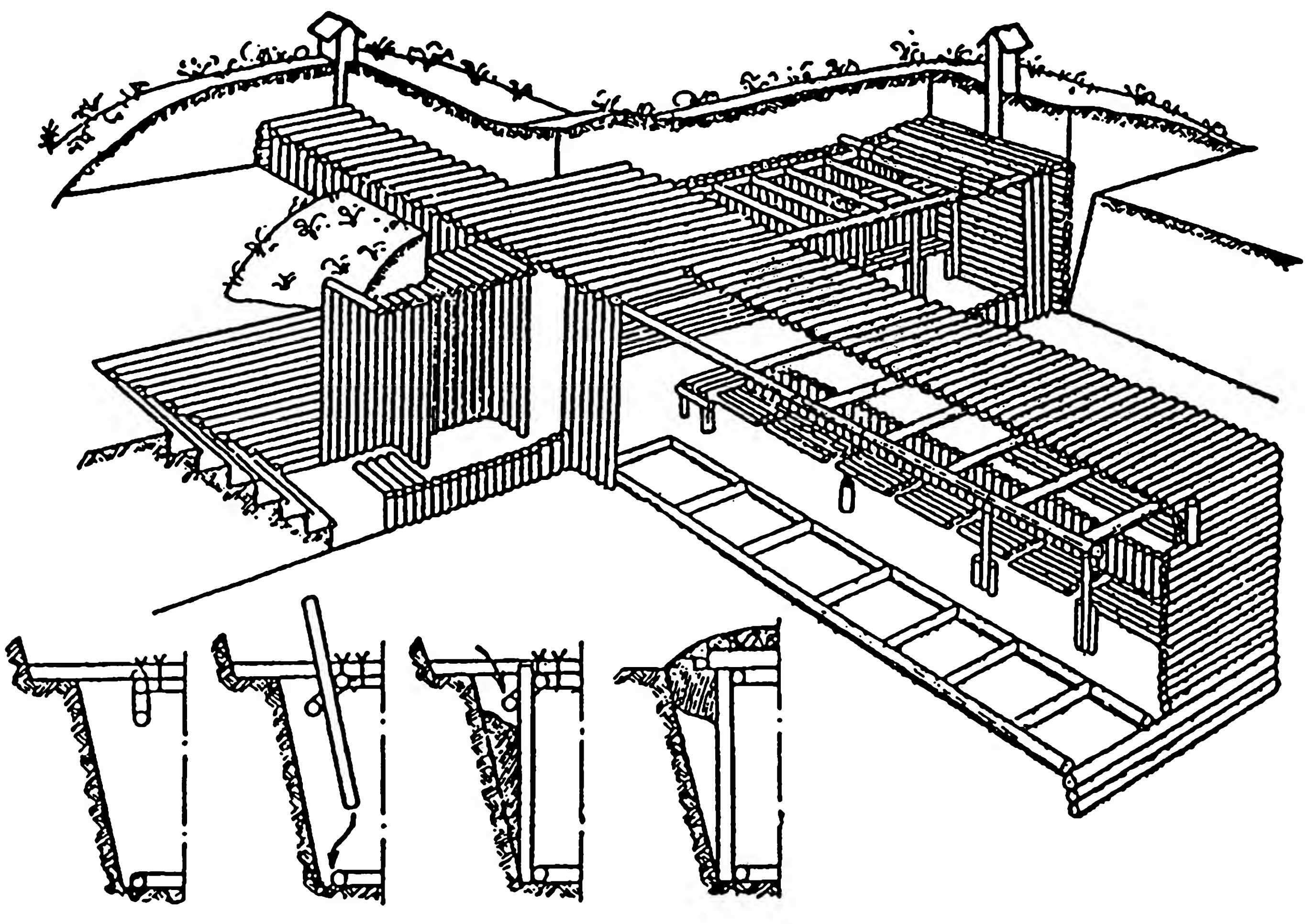
112. These several types of Soviet shelters offer varying degrees of protection against blast and fallout. According to Soviet planning, the type of shelter, its location, and the protection afforded are functions of the priority assigned to the survival of the protected personnel, the likelihood of direct attack or proximity to a target, and the availability of suitable structures that could be adapted as shelters.

113. Detached, bunker-type shelters, adaptable and built-in basement shelters, and subways are available for the protection of both essential workers and the general population. Dual-purpose shelters are also used as underground garages, clubs, and theaters which could be converted quickly to civil defense use.

114. Soviet writings and human sources have also referred to the use of various types of expedient, or temporary, shelters for protection from fallout. They consist of trenches lined with readily available materials and covered with earth. These shelters, which are described in more detail in paragraphs 139-141, are intended primarily for use by the rural population and by the urban population at dispersal and evacuation sites in rural areas. They could also be

Figure 14. Illustration of Soviet Expedient or Hasty Shelter

Diagrams such as this are provided in manuals widely distributed to the Soviet population for use in constructing hasty shelters in dispersal and evacuation areas.



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[USSR, "Antiradiation shelters in rural areas", 1972.]

or evacuee. In práctice, we believe—and emigrés have indicated—that conditions would be much more congested. Details on equipment and supplies for evacuees (including food, water, medicine, and fuel) are discussed later in this chapter.

134. *Time Requirements for Evacuation.* Soviet sources call for evacuation of Soviet cities within the "special period" (a period of warning) preceding an attack, and imply that the evacuation time would be about 72 hours. Soviet authorities have not published their assessment of actual time which would be required for evacuation of the nonessential population. Several US studies have addressed the speed with which the Soviets could complete their evacuation actions. A 1969 RAND study estimated that 100 million urban residents [27] could be evacuated in four days under optimum conditions, using only half of the available 1970 transportation capacity. A 1976 Defense Intelligence Agency study of the evacuation of 12 selected Soviet cities concluded that, under the most favorable conditions, the Soviets have a physical capability to evacuate most of the 12 cities within three to four days after movement begins. The major assumptions used in the DIA study were:

— 70 percent of population evacuated, 30 percent dispersed;

— two shifts working in essential industries and services;

— a six-hour alert preceding actual movements (this period of alert has been tested in Soviet exercises); and

— no other complications, such as panic, severe disruption of transport systems, or adverse weather conditions.

Figures 18, 19, and 20 and Table V summarize the findings of the DIA dispersal and evacuation study.

[27] This number of urban inhabitants equals the total population of some 450 cities with populations of 50,000 or more and includes almost all major administrative, residential, communication, and transportation centers.

TABLE V

DIA-Estimated Time Required for Evacuation of Twelve Selected Soviet Cities

City	Numbers evacuated (thousands) [1]	Maximum distance (km)	Maximum distance (nm)	Estimated time required after movement begins (hours) [2]	Modes of transport
Leningrad	2,673	[3]		117+	mostly rail, some maritime
Kiev	1,407	110	60	36	rail and highway
Tashkent	1,158	260	140	81	rail
Gor'kiy	914	315	170	75	rail and highway
Odessa	718	[4]		58	mostly rail, some maritime
Dnepropetrovsk	684	185	100	57	rail
Khabarovsk	351	410 [5]	220 [5]	56	rail
Orenburg	288	185	100	47	rail
Kishinev	331	75	40	39	rail and highway
Sevastopol'	187	165	90	29	highway
Angarsk	164	410 [5]	220 [5]	42	rail
Kirovabad	141	95	50	25	rail

[1] Represents 70 percent of city's inhabitants.

[2] Movement begins six hours after the alert. Methodology utilized in calculating evacuation times considers variables such as running speeds, loading and unloading rates, and sequences of unloading dictated by availability of facilities. Since these variables are not known quantities but judgments based on available evidence, the resulting figures for total evacuation time are approximate rather than exact values.

[3] Leningrad can accommodate some 90 large oceangoing ships which could offload evacuees at various ports along the Baltic coast, but a cycle time of three to four days is estimated before ships can return for more evacuees.

[4] Odessa, which can handle some 38 oceangoing ships, could offload evacuees in Romania and Bulgaria, but the cycle time for return of ships is four or more days.

[5] Distances for Khabarovsk and Angarsk are greater than for larger cities because of low population density in surrounding areas.

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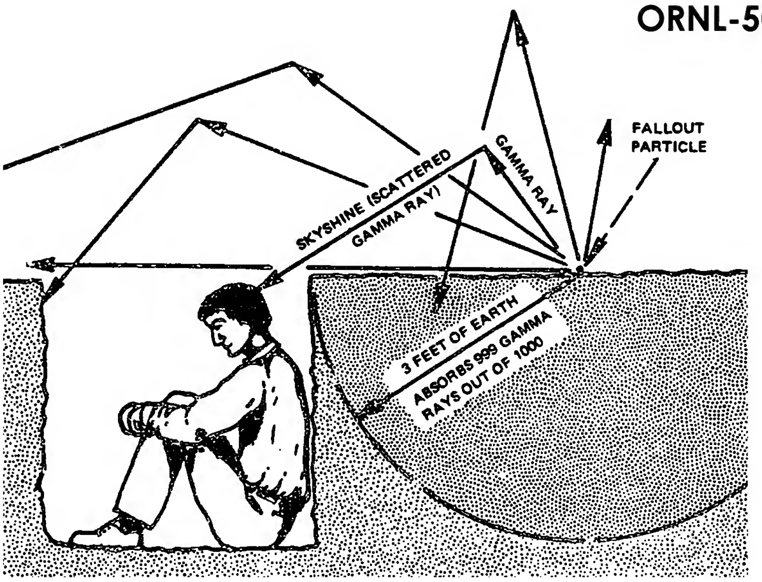
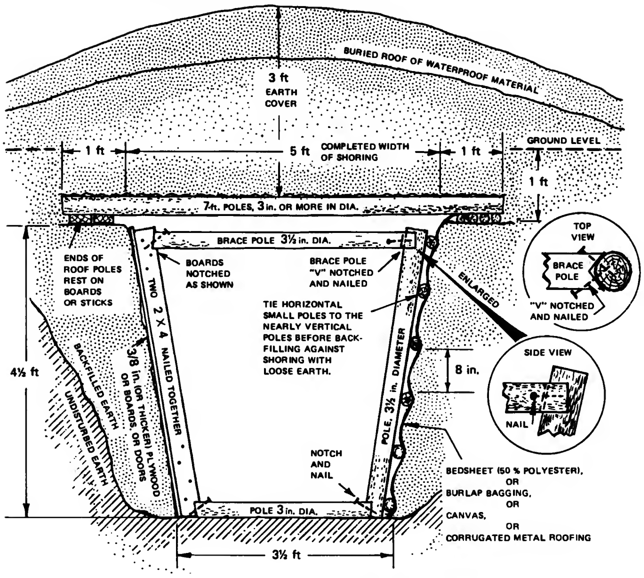
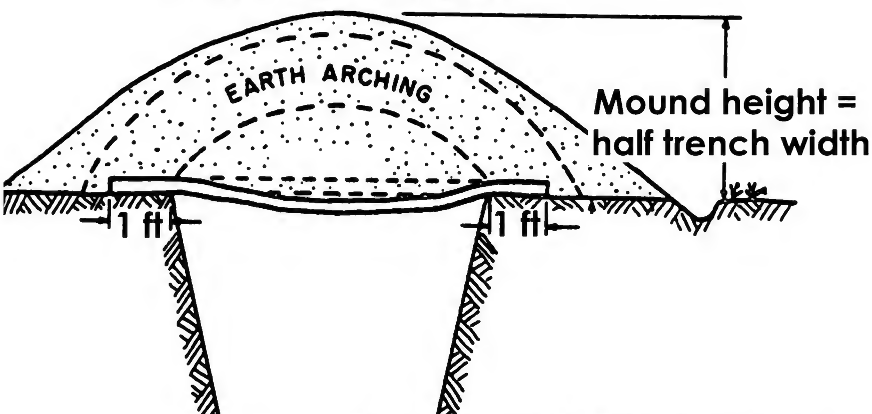


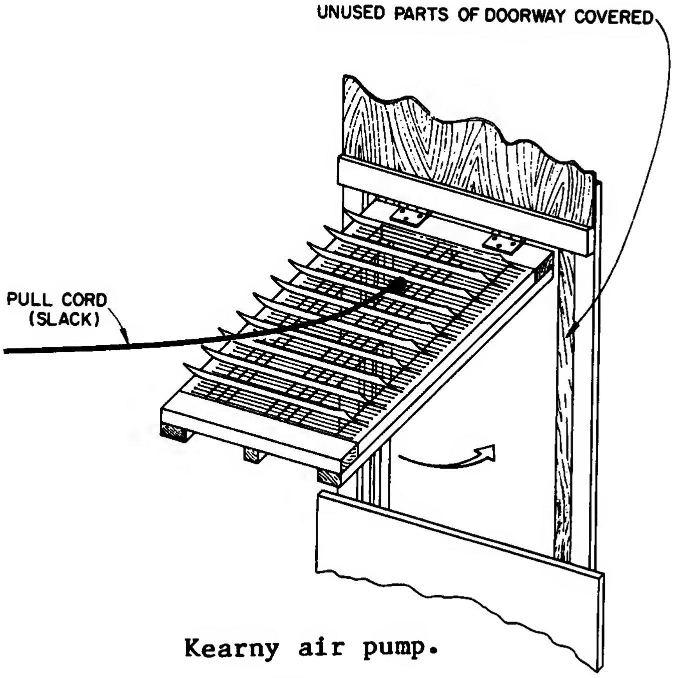
Methods for shoring a trench shelter.



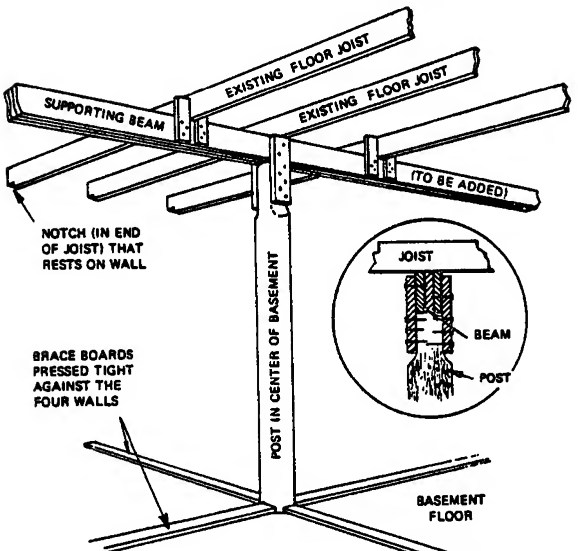
EARTH ARCHING USED TO STRENGTHEN SHELTERS

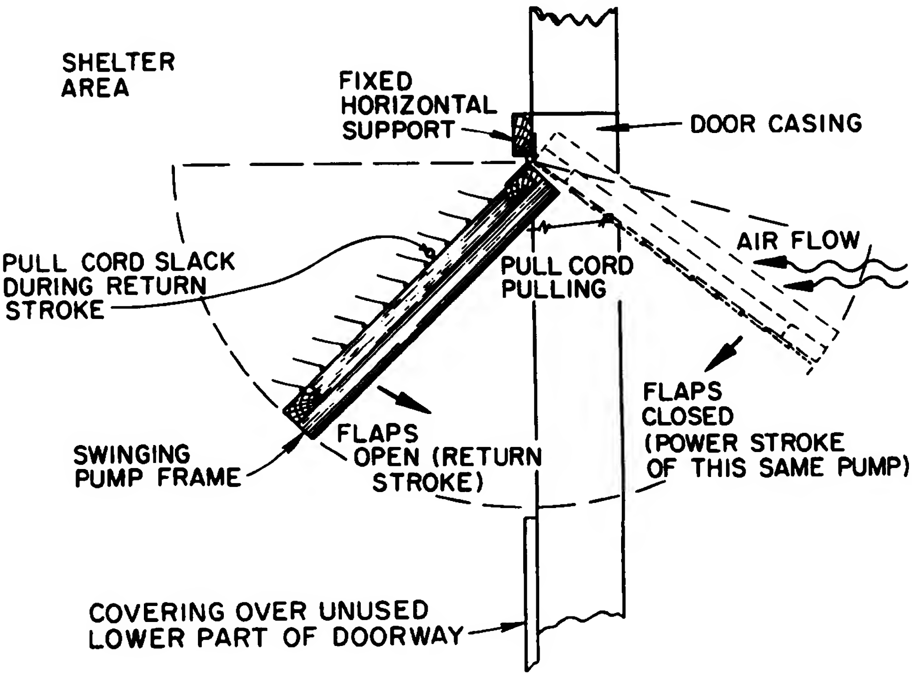


A familiar example of effective earth arching is its use with sheet metal culverts under roads. The arching in a few feet of earth over a thin-walled culvert prevents it from being crushed by the weight of heavy vehicles.



Kearny air pump.





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THIS PUBLICATION SUPERSEDES TM 23-200, OPNAV INSTRUCTION 03400.1B, AFM 136-1/NAVMC 1104 REV, NOVEMBER 1957, INCLUDING CHANGE 1, 24 JUNE 1960 AND CHANGE 2, 3 OCTOBER 1960 THERETO.

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CAPABILITIES OF NUCLEAR WEAPONS [U]

United States Government Printing Office
Washington: 1964

[redacted]

GROUP-3
Downgraded at 12 year intervals;
Not automatically declassified.

Table 7-1 Estimated Casualty Production in Structures for Various Degrees of Structural Damage

Structural damage	Killed outright	Serious injury (hospitalization)	Light injury (No hospitalization)
		Percent*	
1-2 story brick homes (high explosive data):			
Severe damage	25	20	10
Moderate damage	<5	10	5
Light damage		<5	<5
Reinforced-concrete buildings (Japanese data, nuclear):			
Severe damage	100		
Moderate damage	10	15	20
Light damage	<5	<5	15

*These percentages do not include the casualties that may result from fires, asphyxiation, and other causes from failure to extricate trapped personnel. The numbers represent the estimated percentage of casualties expected at the maximum range where the specified structural damage occurs. For the distances at which these degrees of damage occur for various yields see Chapter 8.

example, although such effects as capacitor discharge are usually referred to as transient effects, the time constant for recovery of the capacitor to its normal operating potential may be so long that recovery may not be effected before the mission of the system involved is complete. In this instance the effect would be classified as permanent damage even though the capacitor itself would have eventually completely recovered.

ELECTROMAGNETIC PULSE RADIATION DAMAGE

a. General. Permanent damage due to overheating or puncturing of insulation is possible where the electromagnetic pulse energy is high, where the induced voltage triggers an electrical fault and the damage energy is supplied by the affected system, or where the electromagnetic pulse energy is carried for some distance along a cable or line as a power surge.

Interruption of service may occur where the voltage induced in a cable or line causes fuses to blow or circuit breakers to trip. This may take place many miles away from the point of detonation due to transmission of the surge. An interruption could also result if an electronically stored program were subjected to a strong enough transient electromagnetic field to scramble it.

Transient disturbances to electronic systems may occur in several ways. The electromagnetic pulse may be received via the signal or power lines acting as antennae. Or, the low frequency portion of the pulse may penetrate the enclosures and directly induce transient signals in the circuits.

Many instances of all three kinds of damage, i.e., permanent, interruptive and transient, have been experienced. So far, little if any, correlation of damage with measured electromagnetic field strengths has been established. This has been the result of factors previously described, and of uncertainty of the point where electromagnetic pulse pickup actually occurred in cases where many cables and lines were in use for power, signal, control and mechanical purposes.

b. Power System Damage. Very regular zero-time tripping of power circuit breakers at a substation more than 30 miles away was observed on one series of tests. Standby personnel were always posted to reset the breakers to keep electrical equipment functioning. Within a mile of ground zero, pinholes in underground cable insulation have frequently been found. Such cables carried up to 4160 volts.

At power distribution stations, porcelain cutouts have been observed to arc over and the fuses have often blown. At other stations power transformers have been shorted internally or have had insulating bushings destroyed. Ordinary lightning protective devices provided inadequate protection against the electromagnetic pulse, in those cases.

c. Signal System Damage. Damage to signal systems has also been frequent in the form of burned or fused relays, potentiometers, cable insulation and conductors, as well as blown or damaged meters. In many instances, reviews of the circuits have shown that induced energy caused the damage, rather than triggered system energy. Free ends of cable pairs have often arced and melted.

d. Electronic System Damage. Oscilloscope presentations have frequently been disturbed or obliterated, even as far as 11 miles from ground zero.

Pulse counters in a timing circuit have been scrambled directly by the induced field (this effect has actually been duplicated in a simulation test in which a 1 mfd capacitor was charged to several thousand volts, then discharged into 10 turns of wire wound around the cabinet). Memory circuits employing magnetic elements may be vulnerable to the magnetic field, H, in a direct manner, as well as to the time derivative of the field.

Elaborate protective measures against electromagnetic effects have been devised, on occasion, such as extensive grounding plate systems, double-walled screen rooms, precautions against forming loops, and special bonding. These measures appeared effective on certain occasions, but on others, when higher yield weapons were tested, the precautions did not always suffice.

General recommendations for protection against electromagnetic pulse radiation damage cannot yet be made. Protective measures to be taken will depend principally upon the nature of the target and the degree of protection required.

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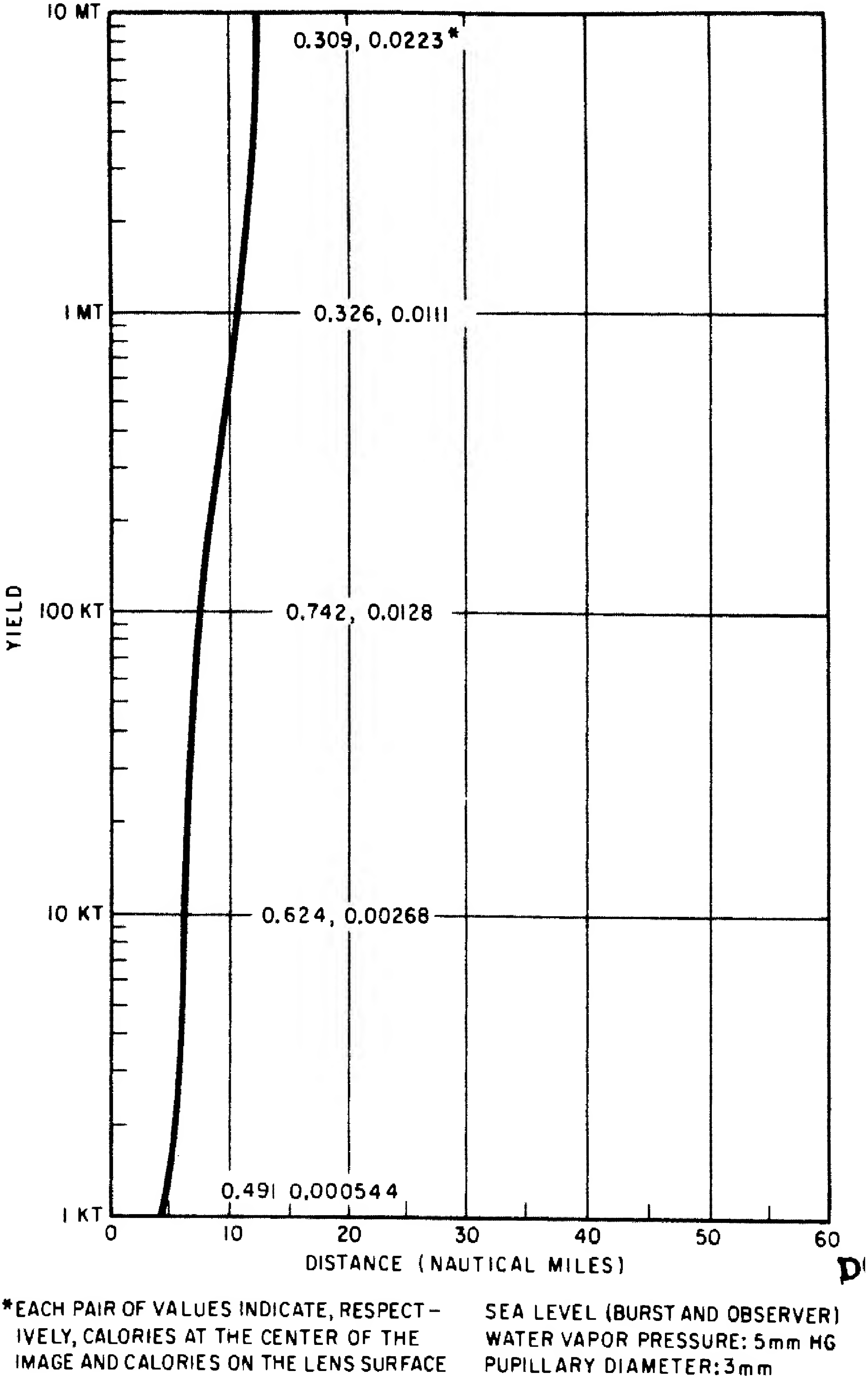

Figure 7-3. Yield vs. Maximum Distance at which a Retinal Burn will be Formed. Visibility 10 Statute Miles; Standard Normal Day, and Daytime Adapted Eye

13-5 FIRE IN URBAN AREAS. The employment of an air burst weapon over urban areas may produce, besides blast damage, mass fires which, under proper conditions, materially increase the degree and extent of damage. The behavior of such fires, whether they are of primary or secondary origin, follows the pattern of fires in forest and wildland areas. The burning potential for urban areas varies with weather conditions, much as for wildlands; however, the fire season as such is not as pronounced as in wildlands. During those seasons when weather conditions may reduce exterior potentials to zero, dwellings are usually heated, so that interior fuels are dried out. Fire incidence and subsequent fire buildup depend also upon the amount and distribution of flammable material used in interior furnishing and building construction, the incidence of interior kindling fuels, and the relative cleanliness of the living habits of the population.

13-6 Ignition Points. A survey of metropolitan areas in the United States indicates that the incidence of exterior ignition points can be correlated with urban land use. Table 13-1 presents a relative tabulation based on exterior kindling fuels. Newspapers and other paper products account for 70 percent of the total, and dry grass and leaves account for another 10 percent in residential areas. Most other exterior kindling fuels are present in small percentages or require radiant exposures in excess of 10 cal/cm^2 for ignition. Weathered and badly checked fences and building exteriors that contain appreciable dry rot constitute an ignition hazard. The tabulation presented in table 13-1 is not representative of European cities and other areas where fuel is at a premium, or where extensive use is made of stone, brick, masonry, and heavy timber construction. Multistory buildings and narrow streets reduce both interior and exterior primary ignitions, because such ignitions are proportional to the amount of sky seen from the location of the probable ignition point.

Table 13-1 Relative Incidence of Ignitions in Metropolitan Areas of the United States by Land Use (Based on Exterior Kindling Fuels).

Land use	Relative incidence
Downtown retail	1.0
Large manufacturing*	1.4
Good residential	1.6
Small manufacturing	3.8
Poor residential	5.2
Neighborhood retail	5.5
Waterfront areas	8.0
Slum residential	11.7
Wholesaler	15.1

* May be likened to a typical fixed military installation in the Z.1.

13-7 Humidity Effects. Because paper is the major exterior kindling fuel and is also an important interior fuel, the extent of ignitions may be estimated from the minimum radiant exposure requirements for newspaper. Figure 13-1 shows the radiant exposure required to ignite darkly printed picture areas and printed text areas of newspaper at 50% relative humidity. The effect of relative humidity on the ignition of this cellulosic fuel can be estimated by multiplying the ignition radiant exposures for the dry material by the factor, $1 + 0.005\,H$, where H is the relative humidity in percent. Maximum fire effects occur during daily periods of lowest relative humidity, usually mid-afternoon. Guides for estimating urban burning potentials are given in figures 13-2 and 13-3. Figure 13-2, which gives burning potential for urban areas when central heating is not in use, represents approximate values of wind speed and average daytime relative humidity conditions corresponding to low, dangerous, and critical burning potentials according to the following definitions:

Low. Slow burning fires; fire can be controlled at will. Control action can be on unit structure basis.

Dangerous. Fires burn rapidly; individual building fires combine to form an area fire. Organized action needed to confine fire to area originally ignited.

[redacted]

Table 13-2 Critical Radiant Exposures for Damage to Various Materials

ambient relative humidity of 65 percent

Material	Weight (oz/sq yd)	Color	Effect on Material	Radiant Exposure (cal/cm^2) 40 kt	1 mt	10 mt
Clothing Fabrics						
Cotton	8	White	Ignites	32	48	85
		Khaki	Tears on flexing	17	27	34
			Ignites	20	30	39
		Olive	Tears on flexing	9	14	21
			Ignites	14	19	21
		Dark Blue	Tears on flexing	11	14	17
			Ignites	14	19	21
Cotton-nylon Mixture	5	Olive	Tears on flexing	8	15	17
			Ignites	12	28	53
Wool	8	White	Tears on flexing	14	25	38
		Khaki	Tears on flexing	14	24	34
		Olive	Tears on flexing	9	13	19
		Dark Blue	Tears on flexing	8	12	18
	20	Dark Blue	Tears on flexing	14	20	26
Rainwear (double neo-prene coated nylon twill)	9	Olive	Begins to melt	5	9	13
			Tears on flexing	8	14	22
Tinder Materials						
Paper, bond, typing, new (white)			Ignites	24	30	50
Newspaper, printed text			Ignites	6	8	15
Newsprint, dark picture area			Ignites	5	7	12
Paper, kraft, single sheet (tan)			Ignites	10	13	20
Rags (black, cotton)			Ignites	10	15	20
Rags (black, rayon)			Ignites	9	14	21
Tent Material						
Canvas, white, 12 oz/sq yd			Ignites	13	28	51
Canvas, OD, 12 oz/sq yd			Ignites	12	18	28
Aluminum aircraft Skin (0.020 in. thick) coated with 0.002 in. of standard white aircraft paint			Blisters	15	30	40
Sandbags, cotton, canvas, dry, filled			Failure	10	18	32
Construction Materials						
Roll Roofing, mineral surface			Ignites	—	>34	>116
Roll Roofing, smooth surface			Ignites	—	30	77
Plywood, douglas fir			Flaming during exposure	9	16	20
Sand, coral			Explosion*	15	27	47
Sand, siliceous			Explosion*	11	19	35
Rubber, pale latex			Ignites	50	80	110
Rubber, black			Ignites	10	20	25

* Popcorning

[redacted]

Table 7-2 Radiant Exposures for Burns Under Clothing

Clothing	Burn	40 kt	1 mt	10 mt
		Radiant exposures[1,2]		
Bare skin	none	2.0	2.6	2.9
	1°	2.6	3.1	3.5
	2°	4.6	6.3	7.0
Summer uniform (2 layers of light porous fabric)	none	5	6	7
	1°	10	16	21
	2°	12	20	26
Winter uniform (2 to 5 layers of tightly woven fabric)	none	7	10	12
	1°	13	21	29
	2°	16	26	36
Sub-artic and arctic (3 to 8 layers of tightly woven fabric)[3]	none	15	25	40
	1°	15	25	40
	2°	15	25	40

[1] Expressed in cal/cm^2 incident on skin or outer surface of clothing when the inner layer of the clothing is spaced 0.5 cm from the skin and when at least the first 70% of the thermal pulse is received normal to the surface.

[2] These values are sensitively dependent on many variables and are probably correct to within ±50% for the range of normal military situations.

[3] Burns to personnel wearing these heavy uniforms will occur only by contact with flaming or glowing outer garments. Some systems require in excess of 100 cal/cm^2 to produce burns by direct transmission of heat through the fabrics.

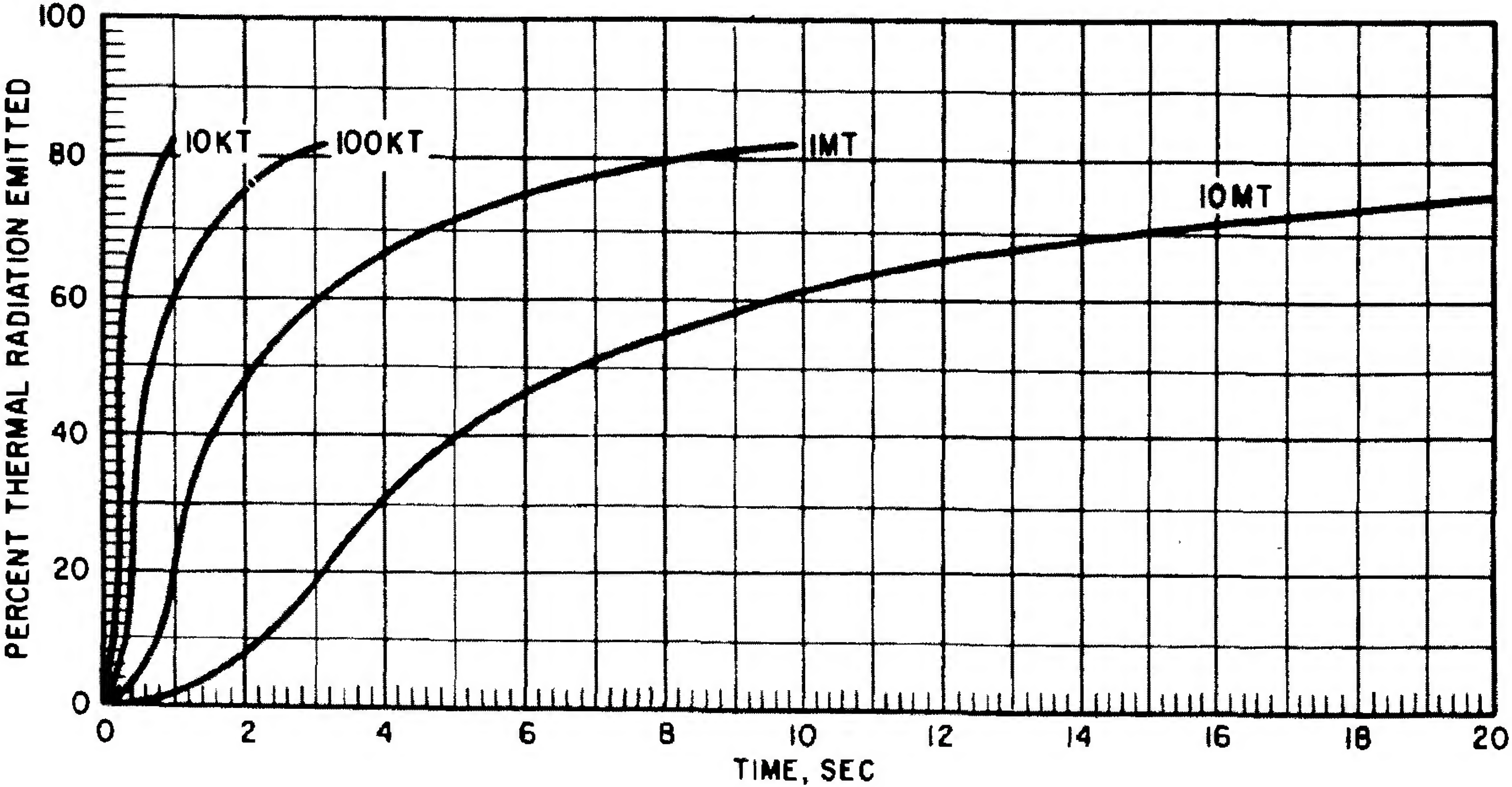

Figure 7-2. Percent Thermal Radiation Emitted vs. Time for Detonations Within the Atmosphere

Teapot-MET (1955)

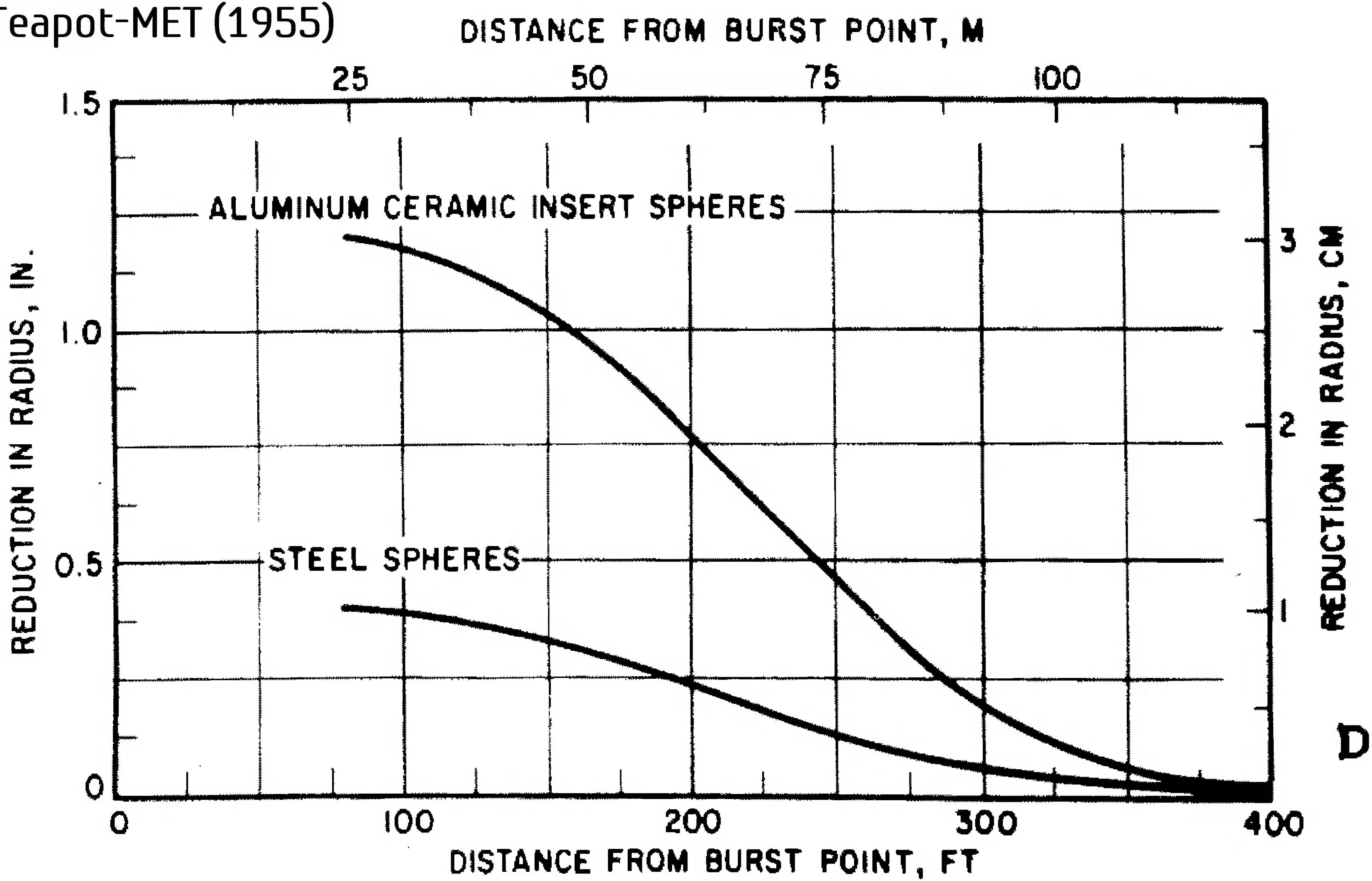

Figure 13-5. Reduction of Sphere Radius with Distance from a 23-kt Burst for Aluminum, Steel, and Ceramic Insert Spheres

Table 7-4 Summary of Clinical Effects of Acute Ionizing Radiation Dose

		Therapeutic range			Lethal range	
		100-200 rems	200-600 rems	600-1000 rems	1000-5000 rems	Over 5000 rems
Range	Subclinical range	Clinical surveillance	Therapy effective	Therapy promising	Therapy palliative	
Incidence of vomiting	None	100 rems: 5% 200 rem:: 50%	300 rems: 100%	100%	Up to 100%	
Delay time	——	3 hours	2 hours	1 hour	30 minutes	
Leading organ	None	Hematopoietic tissue			Gastro-intestinal tract	Central nervous system
Characteristic signs	None	Moderate leukopenia	Severe leukopenia; purpura; hemorrhage; infection. Epilation above 300 rems.		Diarrhea; fever; disturbance of electrolyte balance	Convulsions; tremor; ataxia; lethargy
Critical period postexposure	——	——	4 to 6 weeks		5 to 14 days	1 to 48 hours
Therapy	Reassurance	Reassurance, hematologic surveillance	Blood transfusion; antibiotics	Consider bone marrow transplantation	Maintenance of electrolyte balance	Sedatives
Prognosis	Excellent	Excellent	Good	Guarded	Hopeless	
Convalescent period	None	Several weeks	1-12 months	Long		
Incidence of death	None	None	0-80% (variable)	80-100% (variable)	95-100%	
Death occurs within	——	——	2 months		2 weeks	2 days
Cause of death	——	——	Hemorrhage; infection		Circulatory collapse	Respiratory failure; brain edema

Table 7-5 Dose Transmission Factors (Interior Dose/Exterior Dose)

Geometry	*Gamma rays* Initial	Residual	*Neutrons*[1]
Foxholes[2]	0.20	0.10	0.30
Underground—3 ft	0.04-0.05	0.0002	0.002-0.01
Builtup city area (in open)	—	0.70	—
Frame house	0.80	0.30-0.60	0.3-0.8
Basement	0.05-0.5	0.05-0.1	0.1-0.8
Multistory building:			
Upper	0.9	0.01	0.9-1.0
Lower	0.3-0.6	0.1	0.9-1.0
Blockhouse walls:			
9 in	0.1	0.007-0.09	0.3-0.5
12 in	0.05-0.09	0.001-0.03	0.2-0.4
24 in	0.01-0.03	0.0001-0.002	0.1-0.2
Factory, 200 x 200 ft	—	0.1-0.2	—
Shelter, partly above grade:			
With earth cover—2 ft	0.02-0.04	0.005-0.02	0.02-0.08
With earth cover—3 ft	0.01-0.02	0.001-0.005	0.01-0.05
Rough Terrain	—	0.4-0.8	—
Tanks: M-24, M-41, Tank Recov. Vehicle M-51, M-74	0.3-0.5	0.2	0.5-0.7
Tanks: M-26, M-47, M-48, T-43E1; Eng. Armd. Vehicles, T-39E2	0.2-0.4	0.1	0.3-0.6
Tractor, crawler, D8 w/blade	1.0	0.4	1.0
1/4-ton truck	1.0	0.8	1.0
3/4-ton truck	1.0	0.6	1.0
2-1/2-ton truck	1.0	0.5-0.6	1.0
Armd. Inf. Vehicle M-59, M-75. and 8P Twin 40mm Gun M-42	0.8-1.2	0.2-0.6	0.8-1.0
SP 105-mm howitzer M-52	0.6-0.8	0.4-0.6	0.8-1.0
Cruisers[3]			
Navigating Bridge	0.12-0.35	0.005-0.2	0.75
Superstructure Deck	0.008-0.25	0.0001-0.1	0.7
Main Deck	0.005-0.25	0.00003-0.1	0.7
Second Deck	0.0002-0.2	0-0.07	0.6
First Platform	0.0002-0.2	0-0.07	0.2-0.3
Second Platform	0.0001-0.10	0-0.01	0.05-0.15
Destroyer[3]			
Navigating Bridge	0.25-0.40	0.1-0.2	0.85
Superstructure Deck	0.015-0.40	0.00025-0.2	0.8-0.85 D
Main Deck	0.008-0.34	0.0001-0.2	0.75-0.8
First Platform	0.001-0.25	0-0.1	0.75-0.8
Second Platform	0.0005-0.20	0-0.07	0.5-0.75

[1] Estimated values.

[2] No line-of-sight radiation received.

[3] Assuming a beam-on orientation.

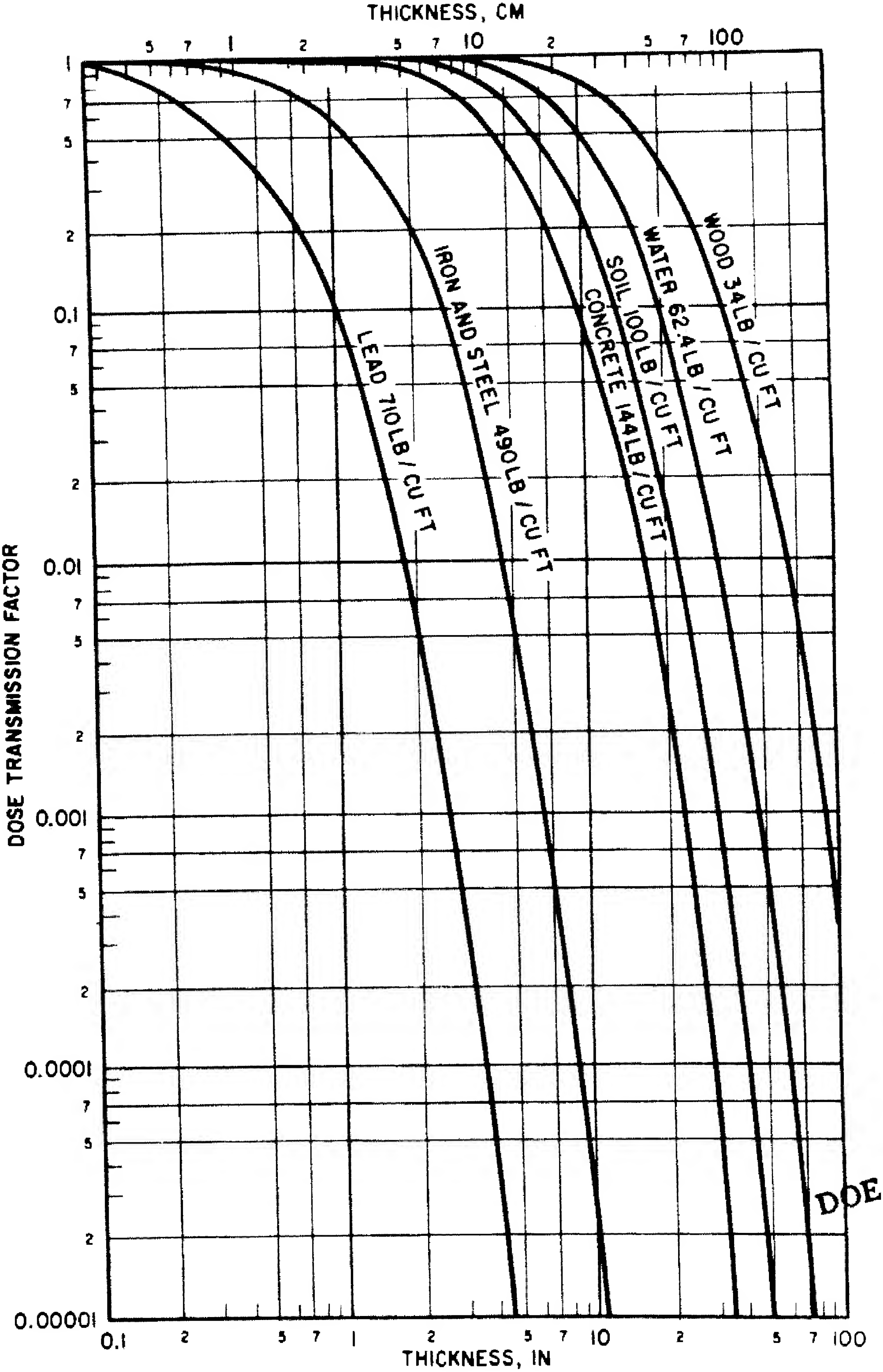

Figure 7-12. Shielding from Residual Gamma Radiation

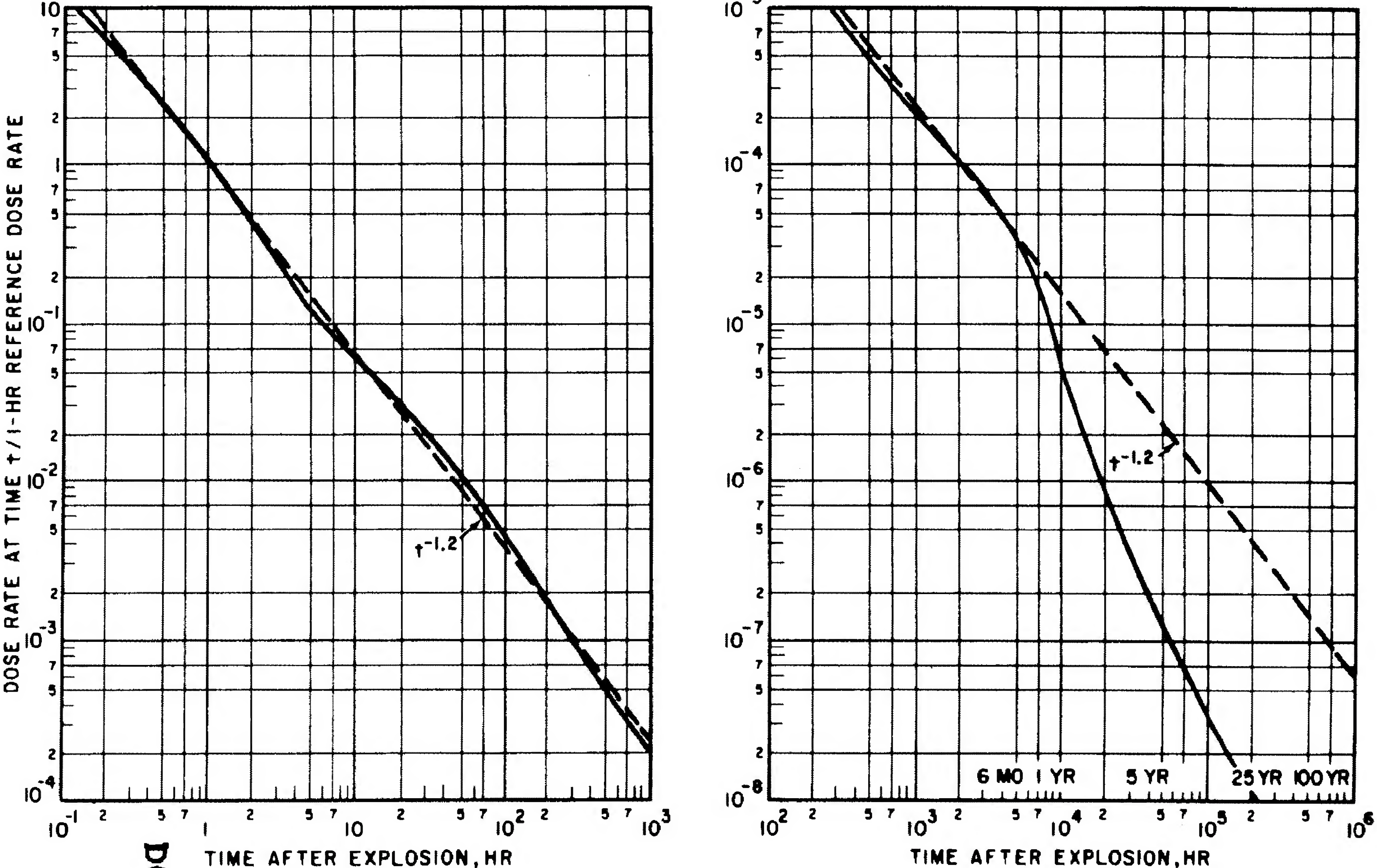

Figure 4-21. Fission-product Decay Factors Normalized to Unity, 1 hr after Detonation

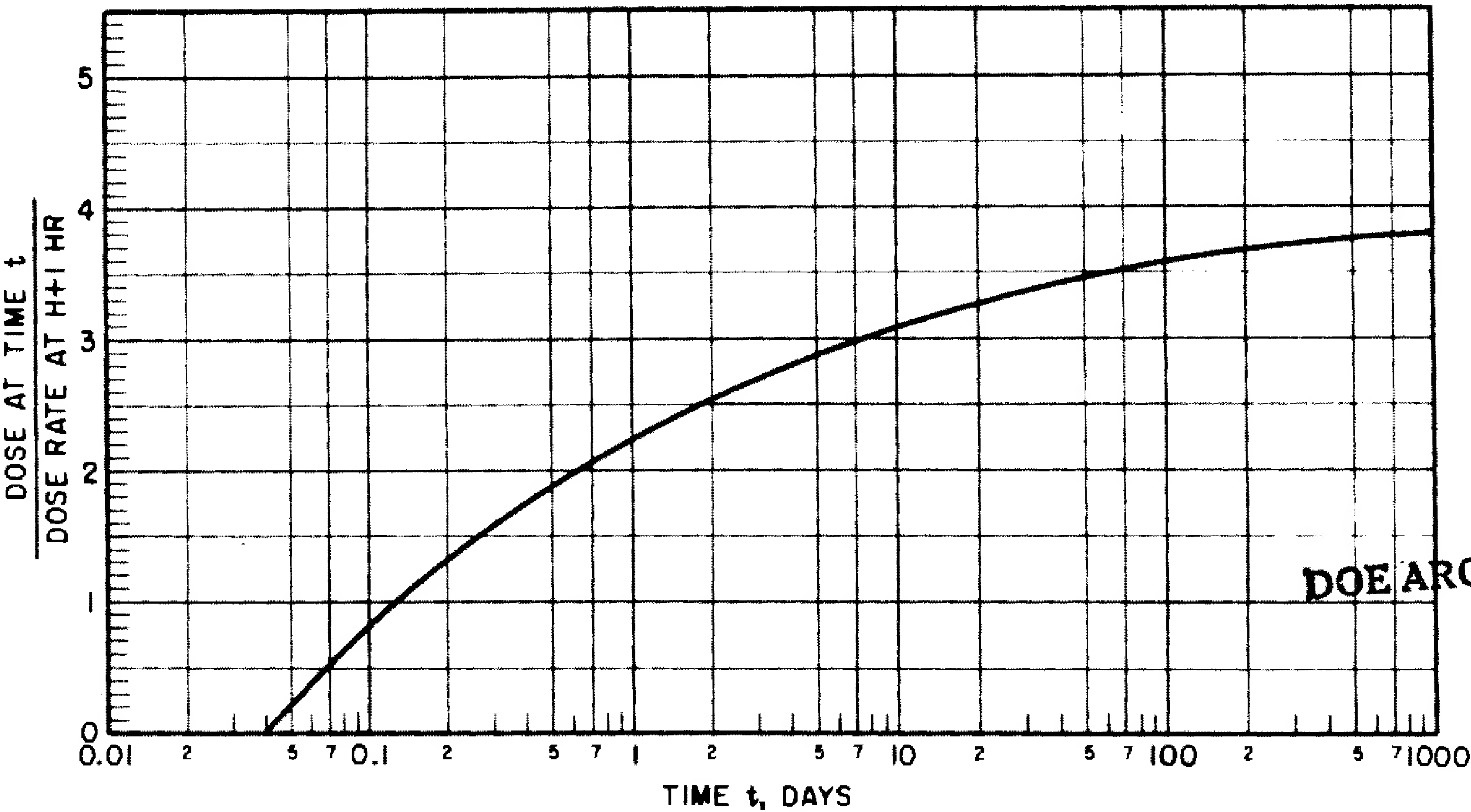

Figure 4-22. Normalized Theoretical Dose Accumulated in a Fallout-contaminated Area from $H + 1$ hr to $H + 1000$ Days

4-13 AIR BURST. The surface contamination effects of fallout from an air-burst weapon are militarily insignificant in most cases because the bomb cloud carries most of the radioactive bomb debris to high altitudes. In general, by the time this material can fall back to earth, dilution and radioactive decay decreases the activity to levels that are no longer militarily important. An exception may occur in the case of a small-yield weapon burst in the rain, where the scavenging effect of the precipitation may cause a rainout of radioactive material that will be hazardous to personnel located downwind and downhill, and outside the hazard area of initial radiation and other effects. Although the range of weapon yields for which rainout may become hazardous is not large, quantitative treatment of the problem is difficult. The contamination pattern on the ground depends upon the scavenging effect of precipitation on suspended fission products in the atmoshere, and the flow and ground absorption of rain water after reaching the ground.

Some of the factors that influence the scavenging effect are:

(1) Height and extent of the rain cloud
(2) Raindrop size and distribution
(3) Rate of rainfall
(4) Duration of precipitation
(5) Position of the nuclear cloud relative to the precipitation
(6) Hygroscopic character of the fission products
(7) Solubility of the fission products
(8) Size of the fission fragments

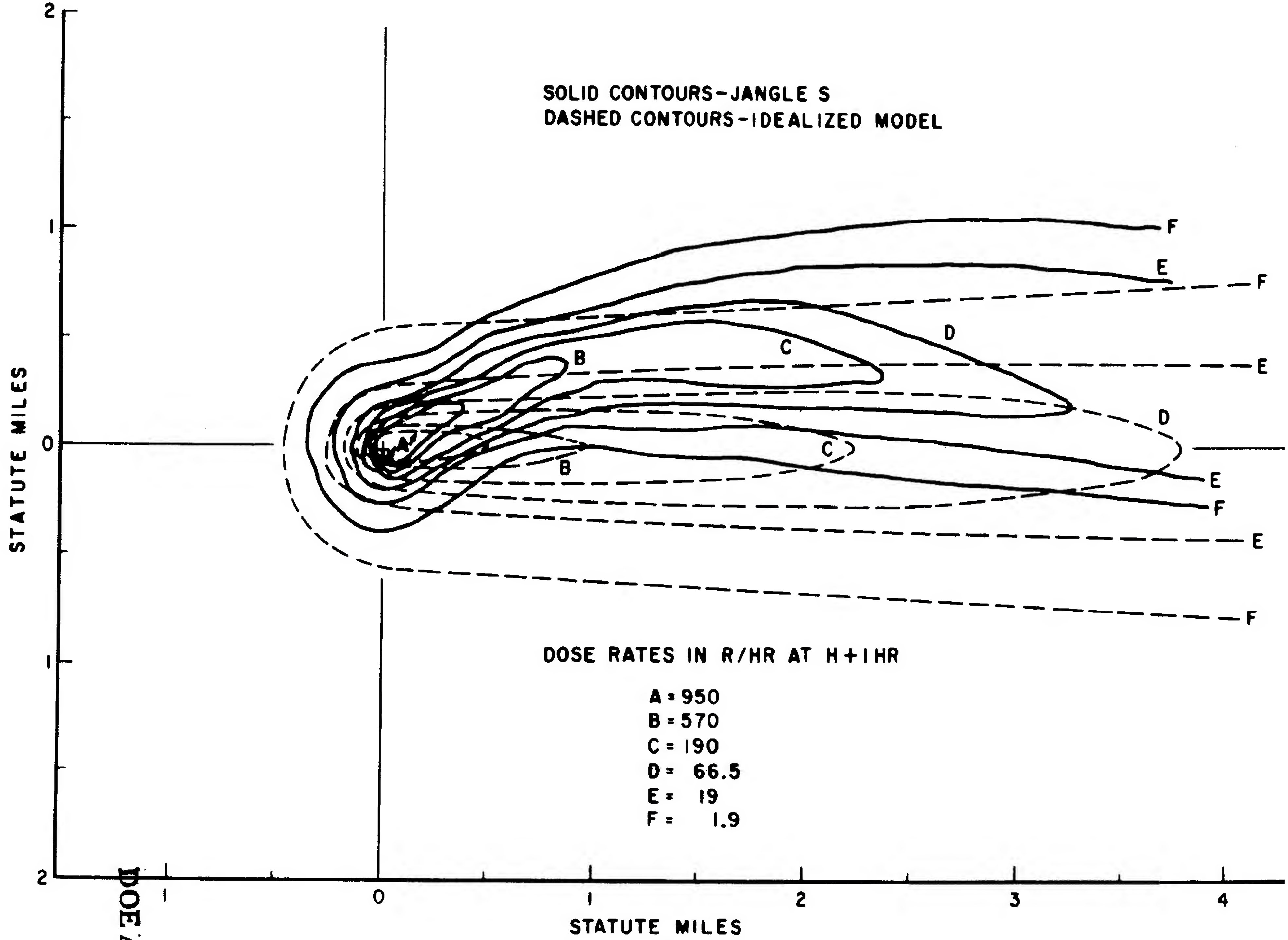

Figure 4-3. Comparison of Actual Fallout Contours with Idealized Model for a Yield of 1.2 kt and Effective Wind of 20 knots

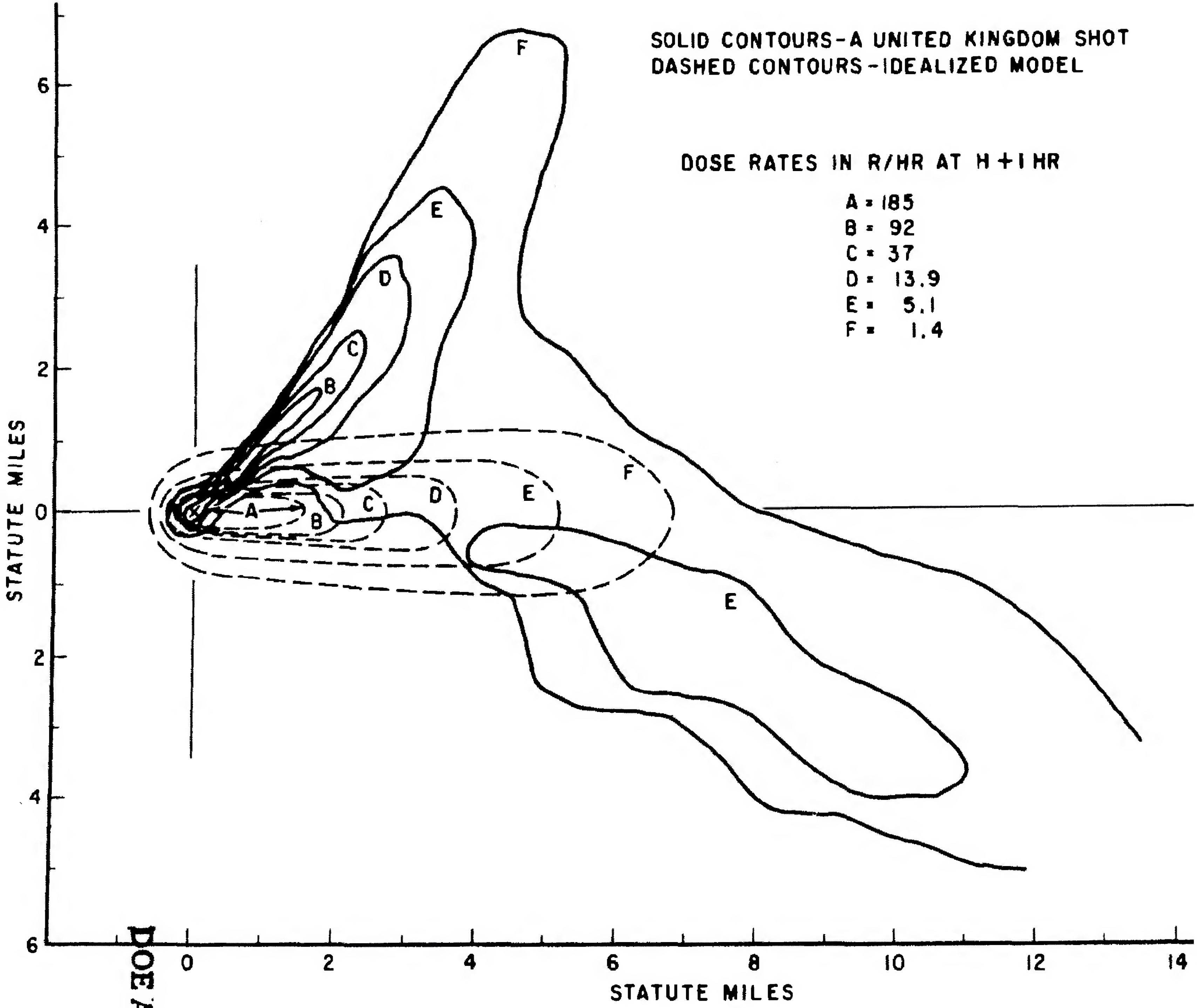

Figure 4-4. Comparison of Actual Fallout Contours with Idealized Model for a Yield of 1 kt and Effective Wind of 10 knots

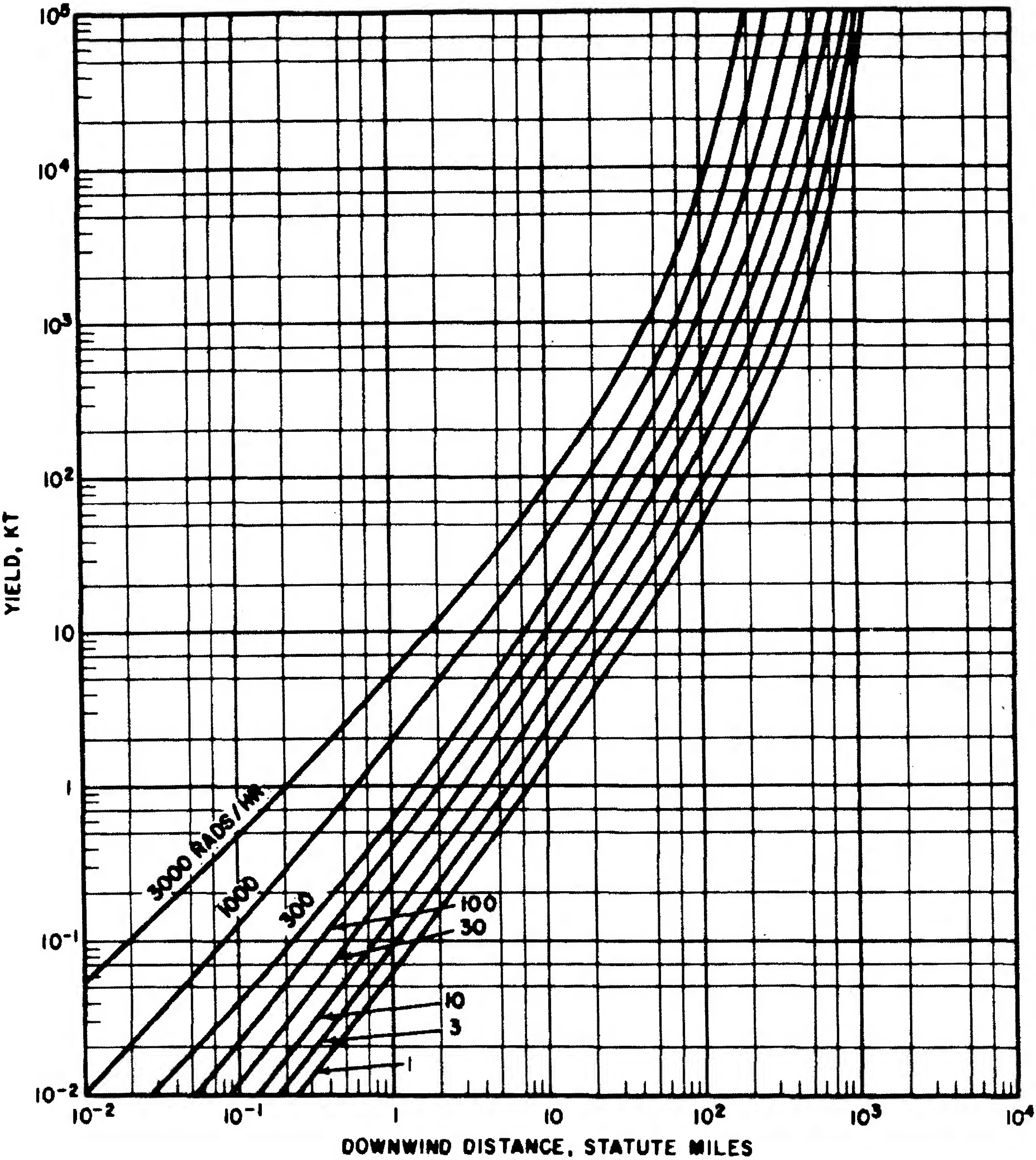

Figure 4-23. Yield vs. Downwind Distance, 10-knot Effective Wind

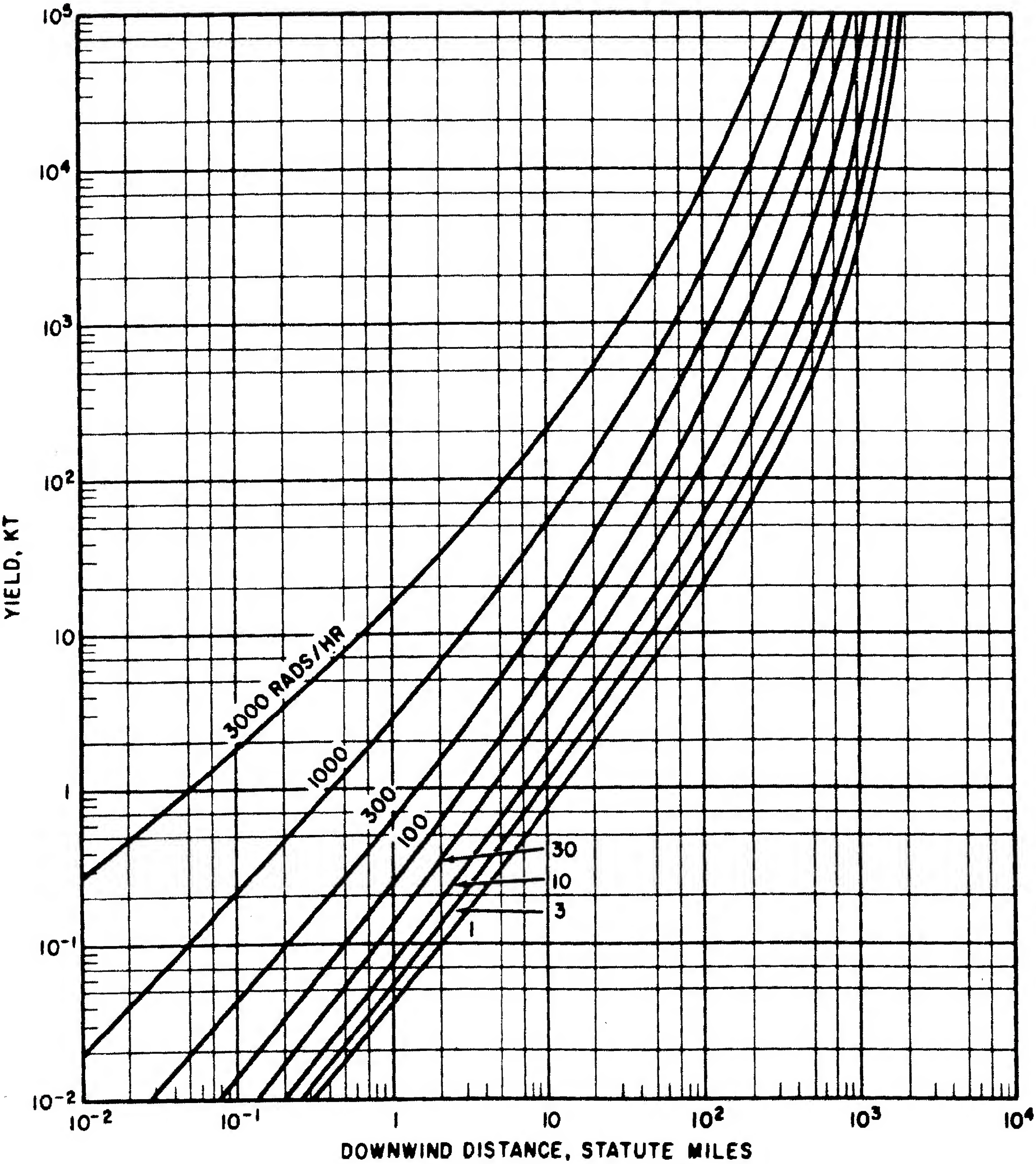

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Figure 4-24. Yield vs. Downwind Distance, 20-knot Effective Wind

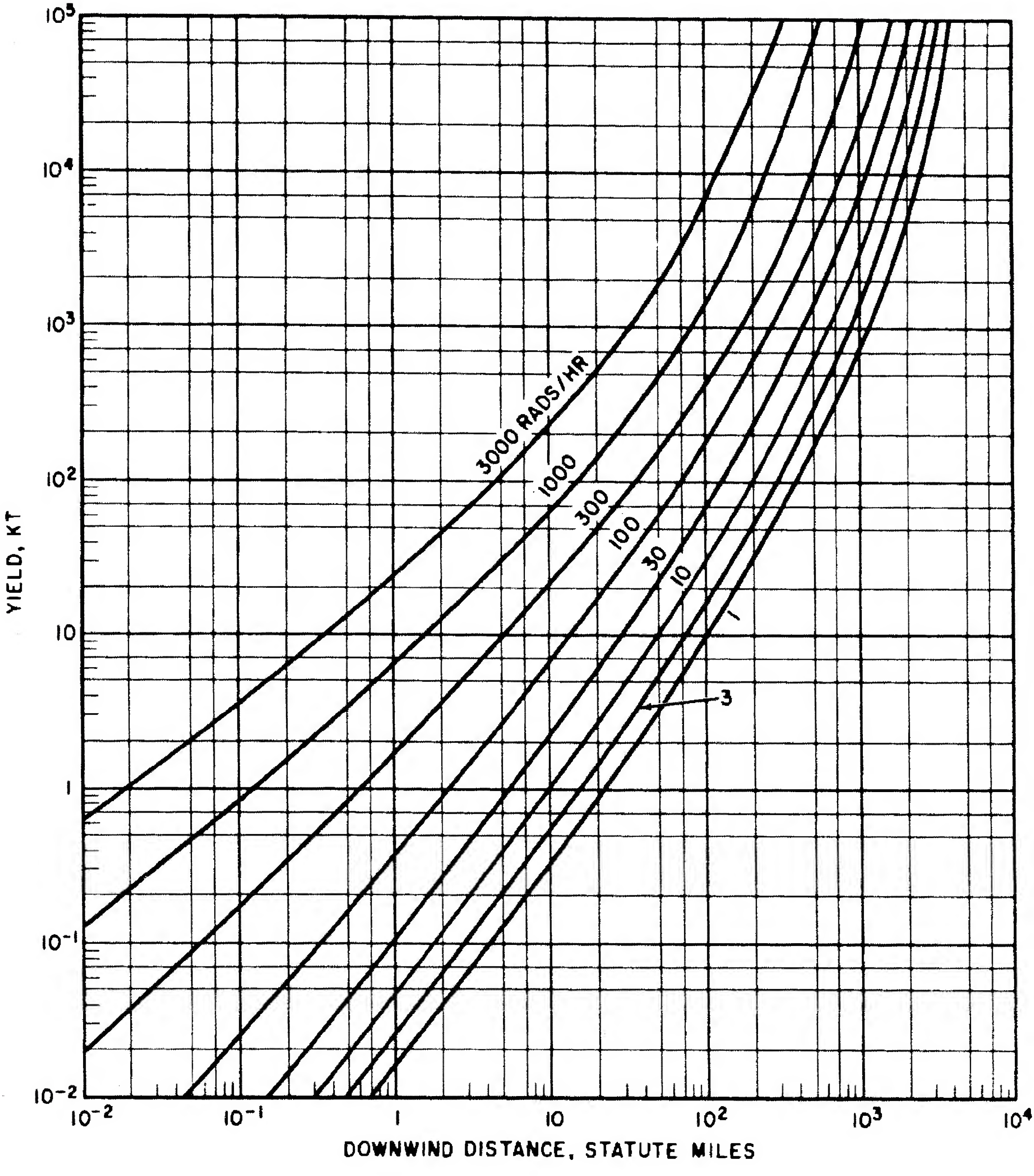

Figure 4-25. Yield vs. Downwind Distance, 40-knot Effective Wind

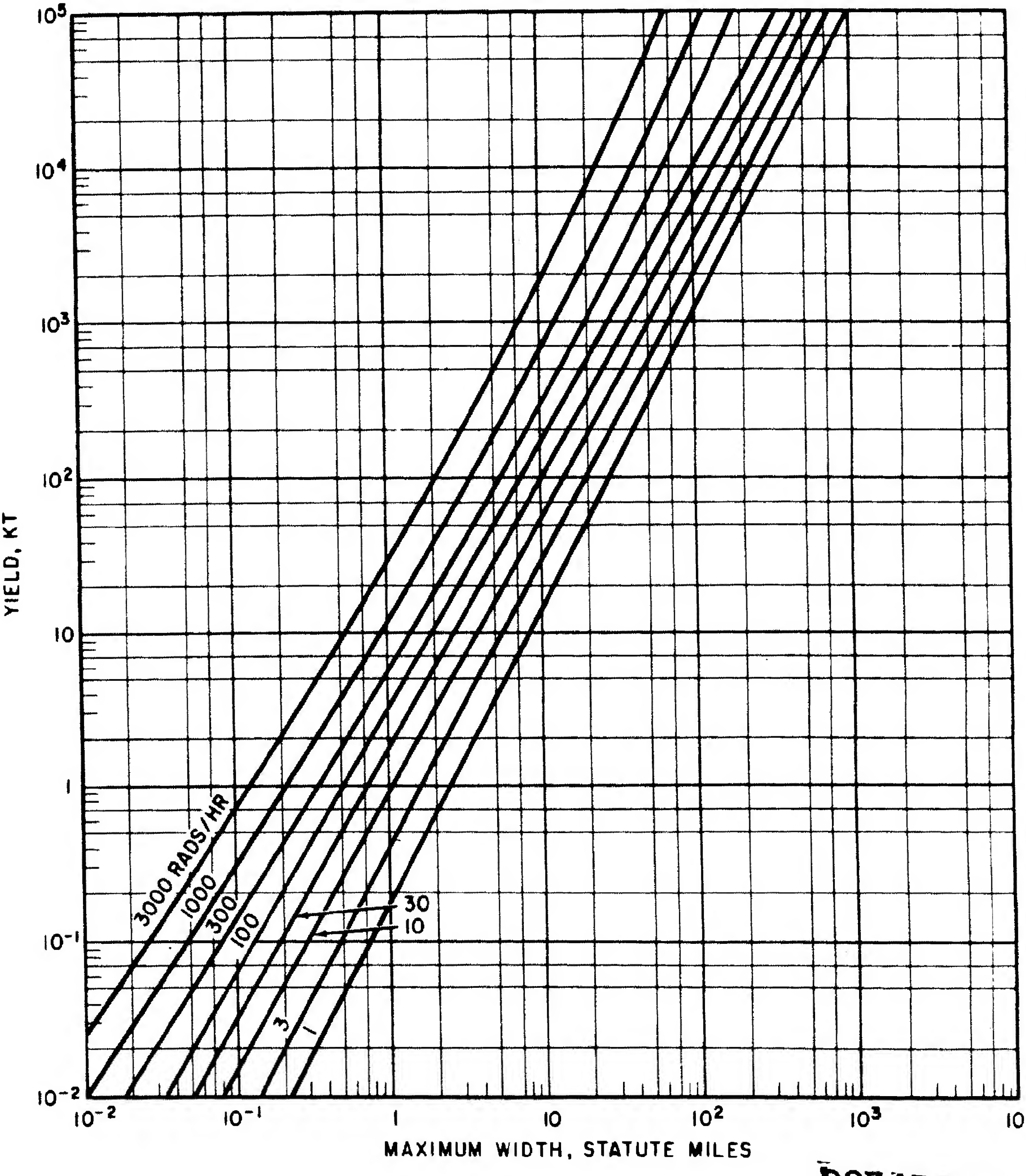

Figure 4-27. Yield vs. Maximum Width, 10-knot Effective Wind

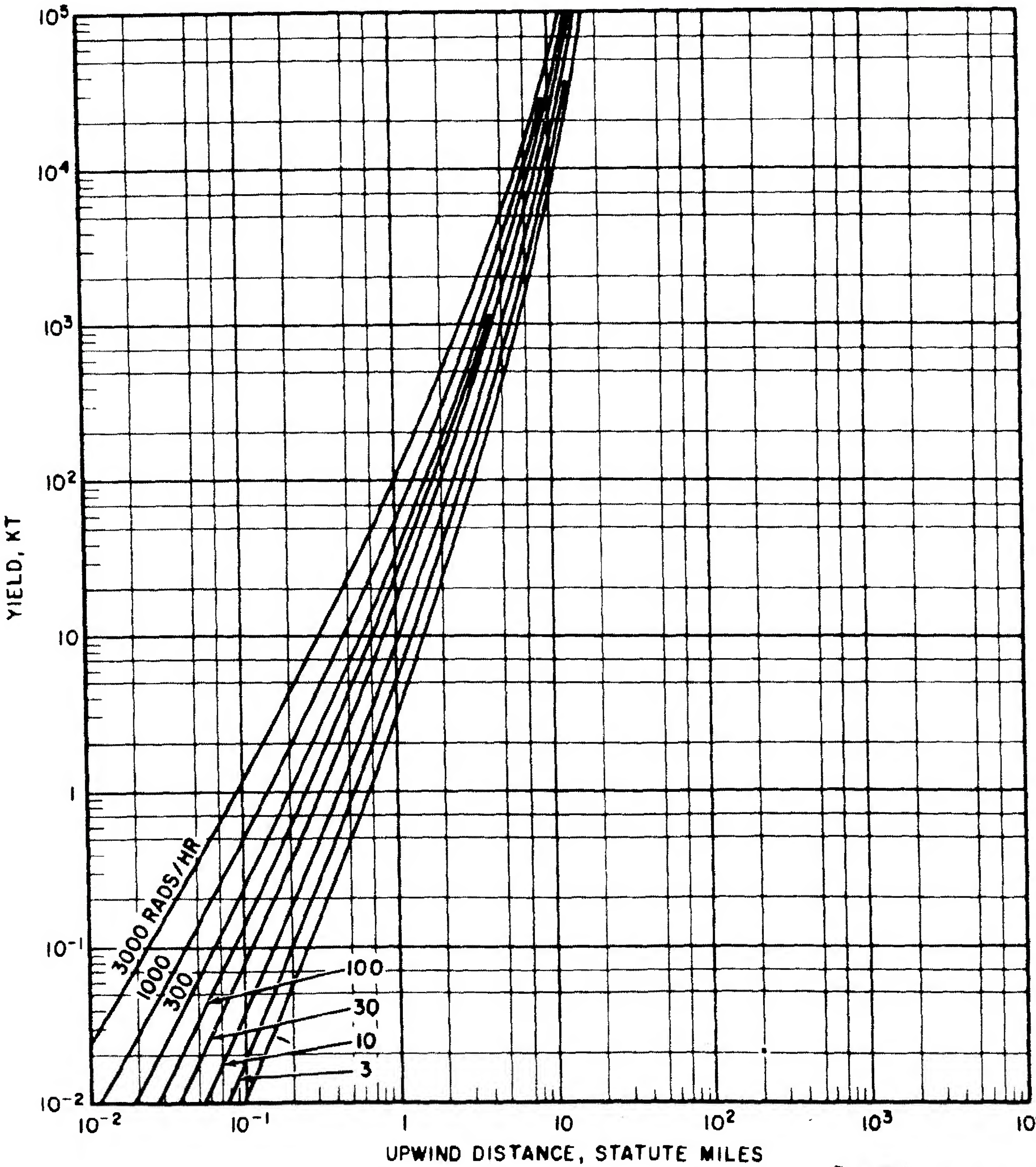

Figure 4-31. Yield vs. Upwind Distance, 10-knot Effective Wind

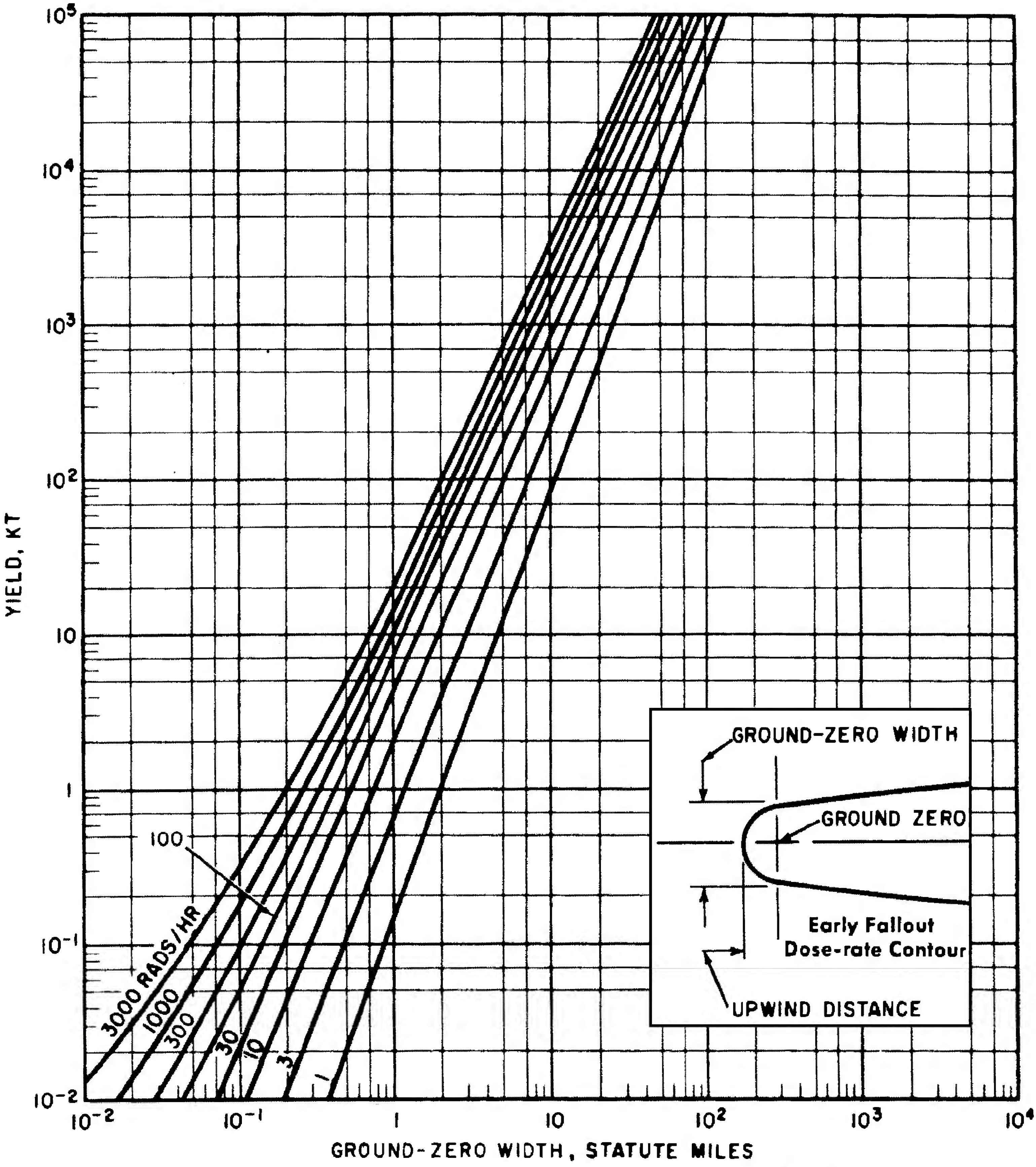

Figure 4-39. Yield vs. Ground-zero Width, 10-knot Effective Wind

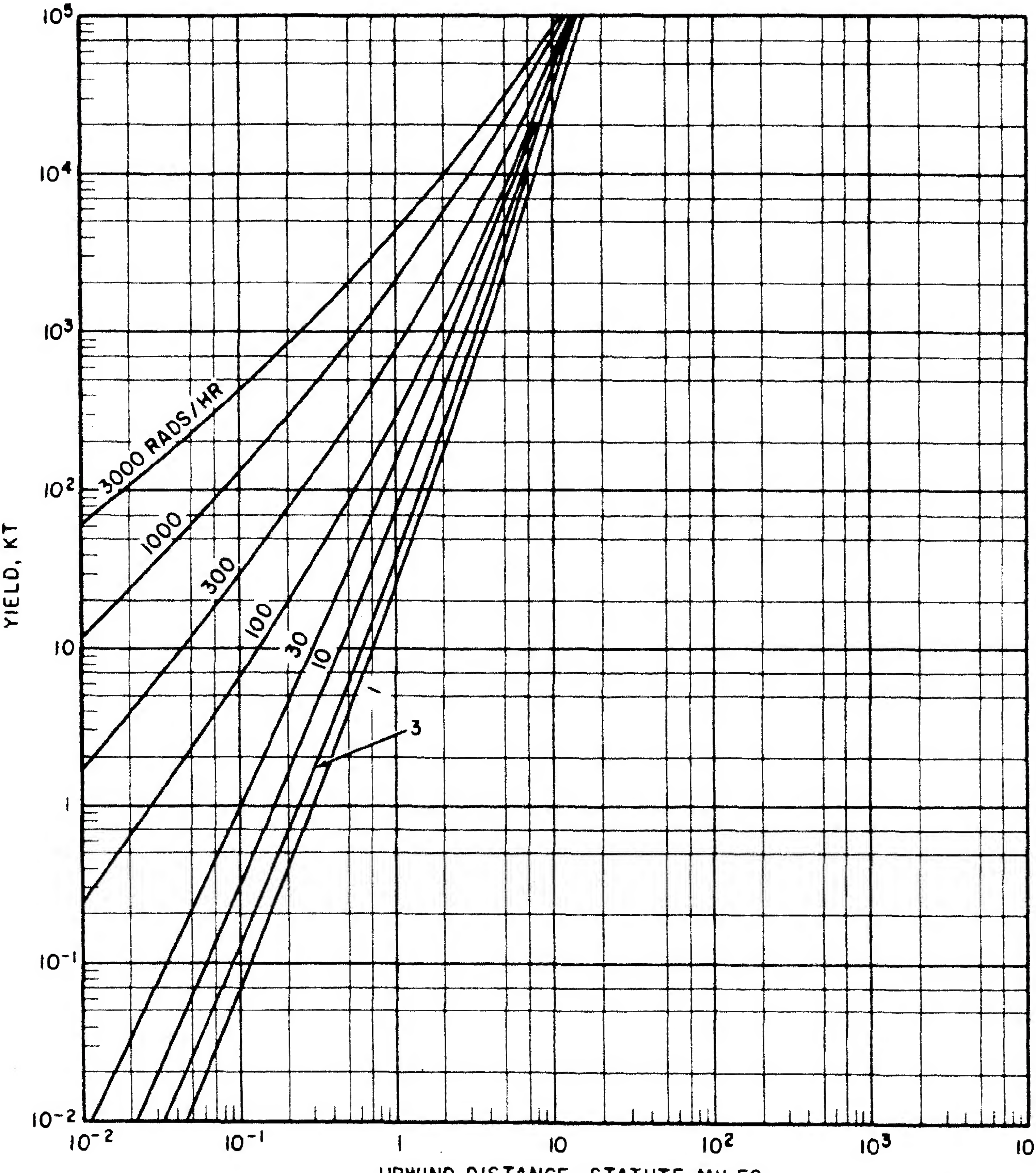

Figure 4-33. Yield vs. Upwind Distance, 40-knot Effective Wind

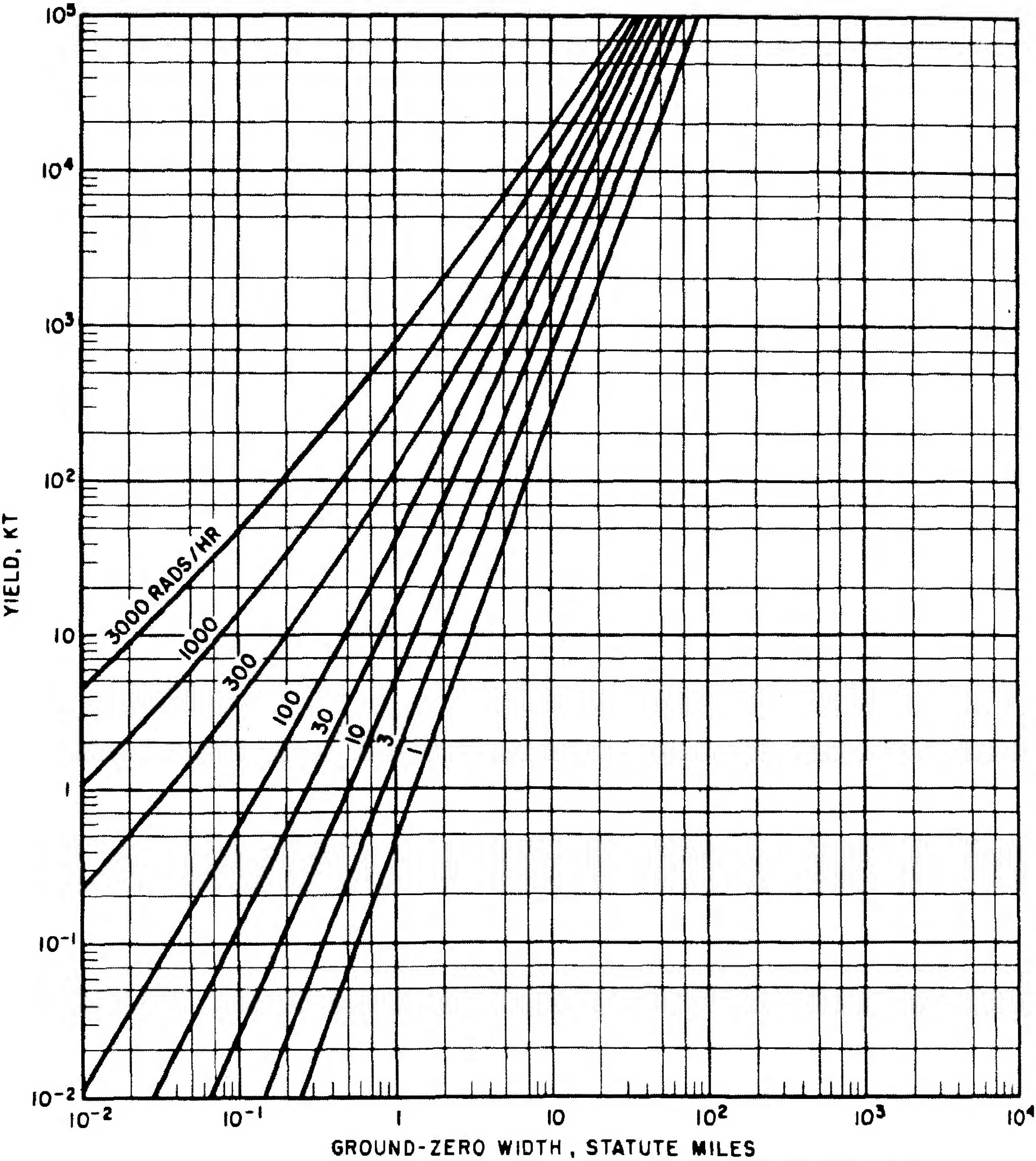

Figure 4-41. Yield vs. Ground-zero Width, 40-knot Effective Wind

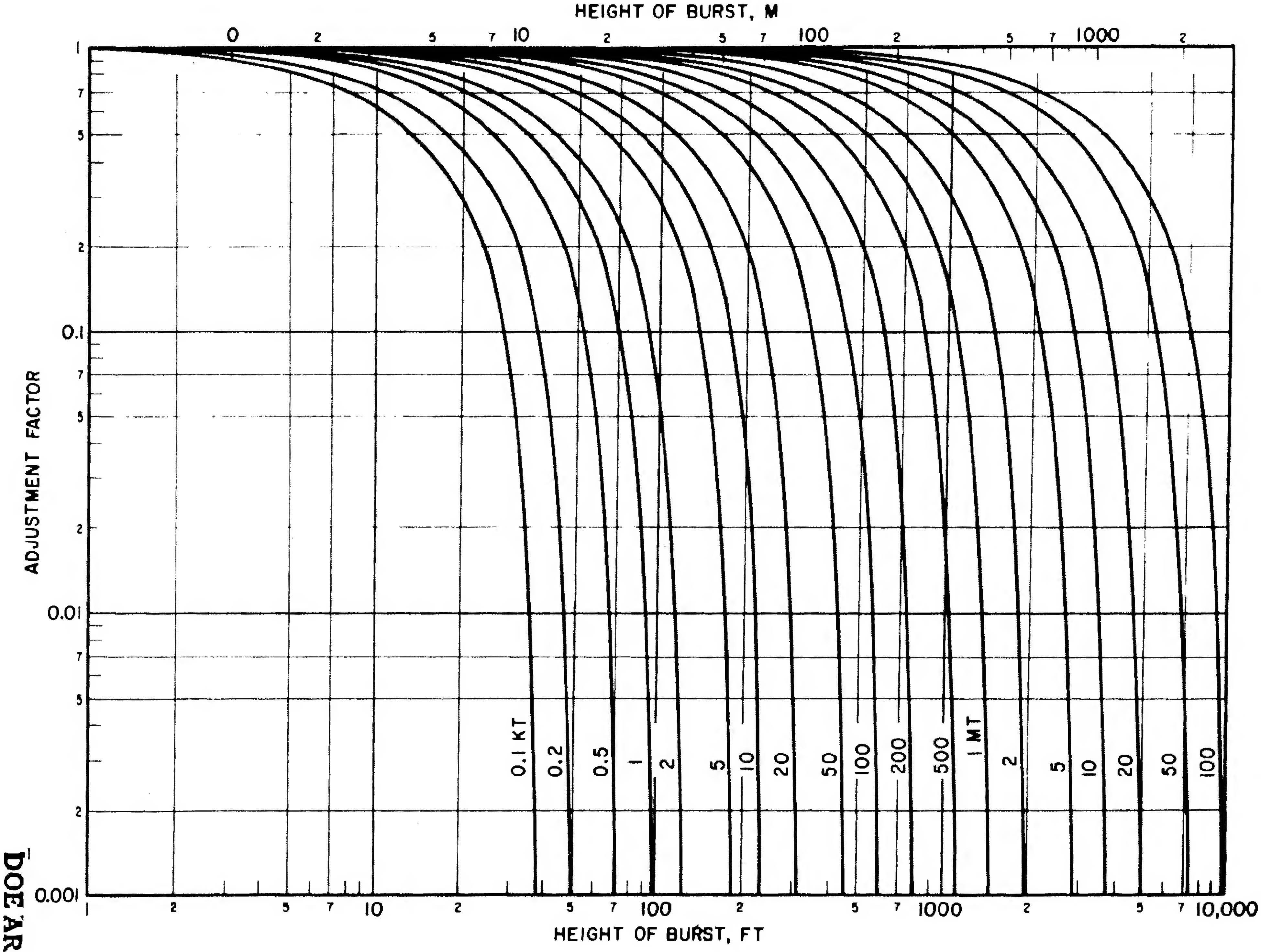

Figure 4-44. Height-of-burst Adjustment Factor for Dose-rate-contour Values Underwater Explosion, 15-knot Wind, Range of Burst Depths, 150 to 1000 ft

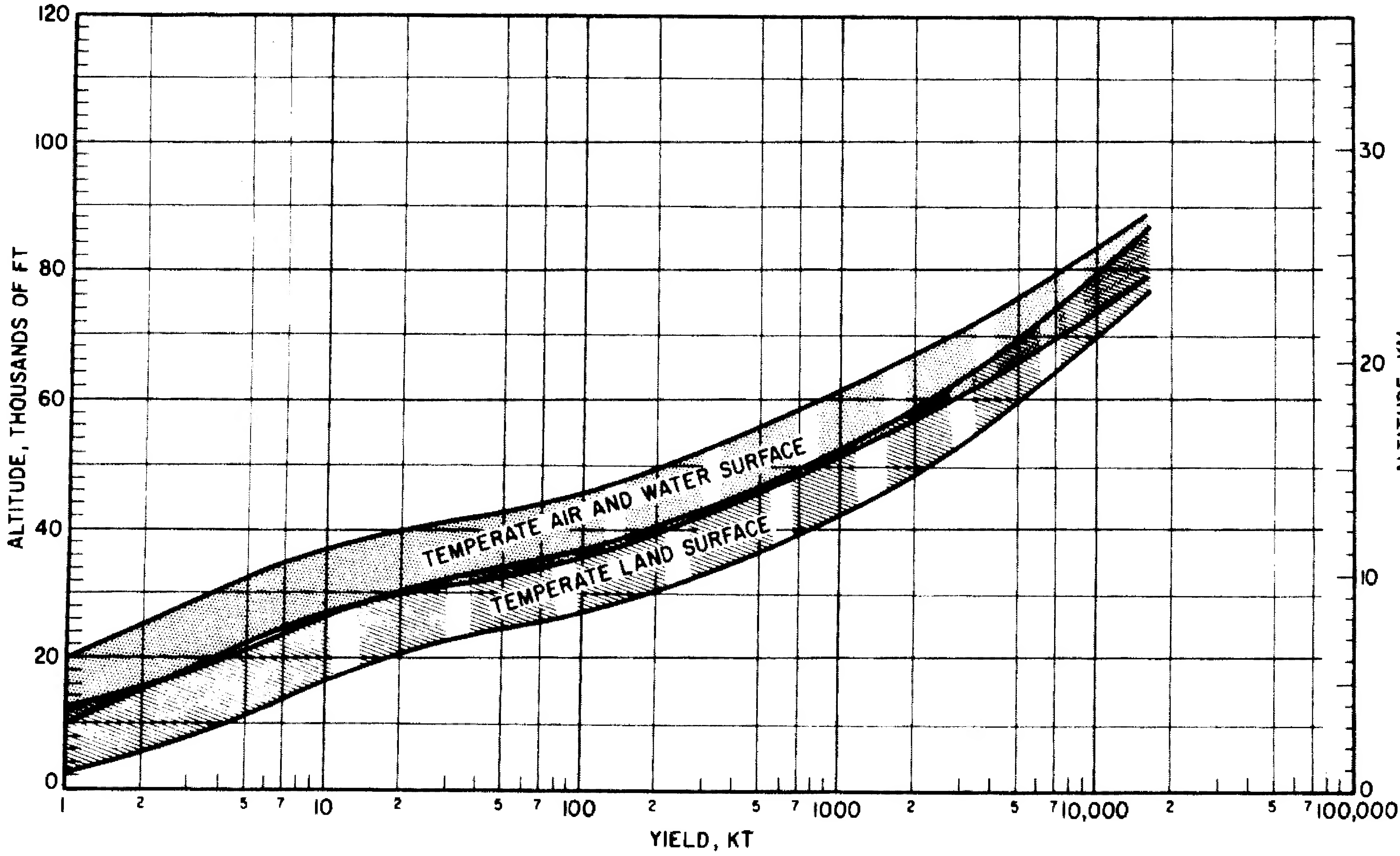

Figure 4-52. Height of Cloud Tops vs. Yield, Temperate Climates

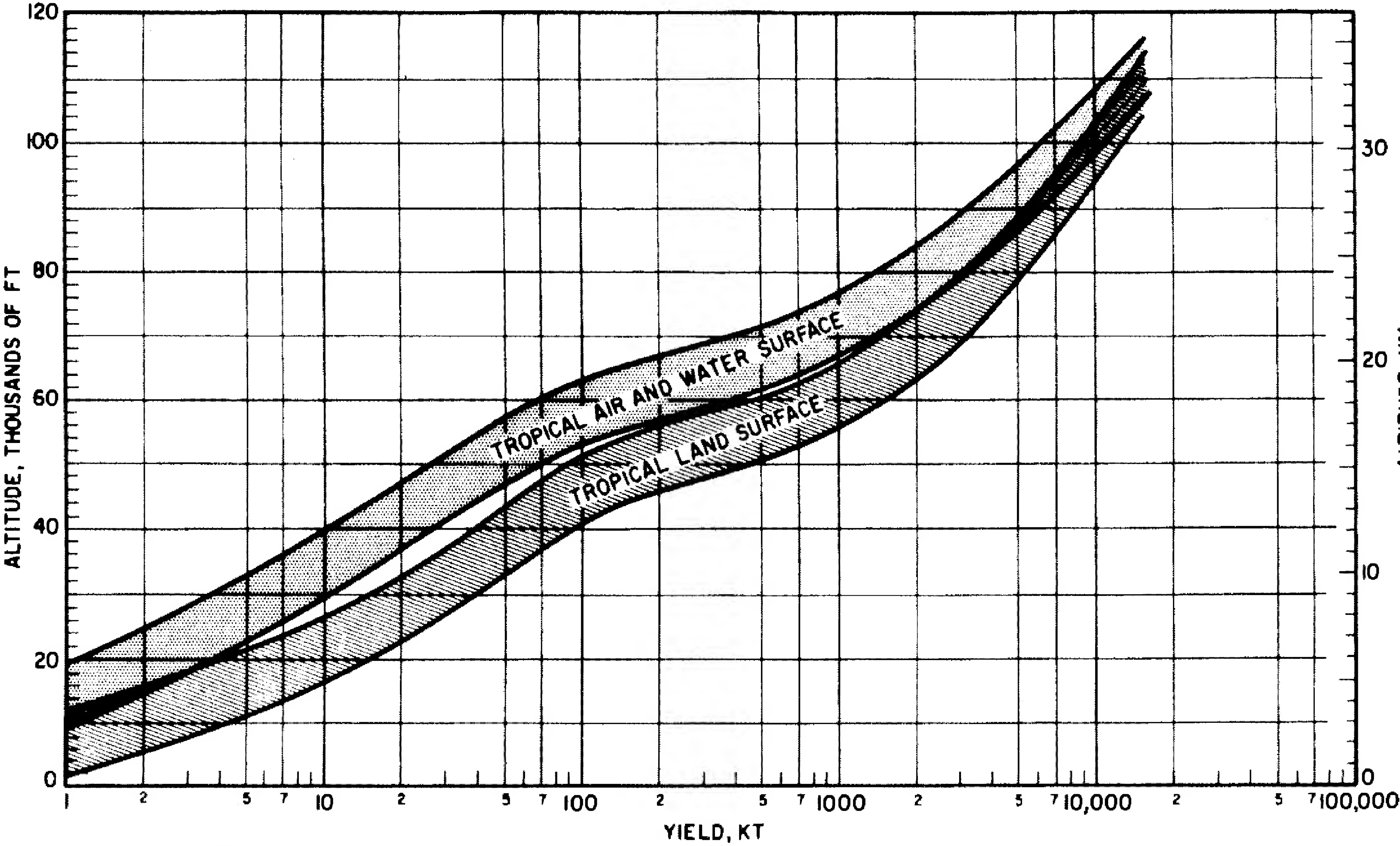

Figure 4-53. Height of Cloud Tops vs. Yield, Tropical Climates

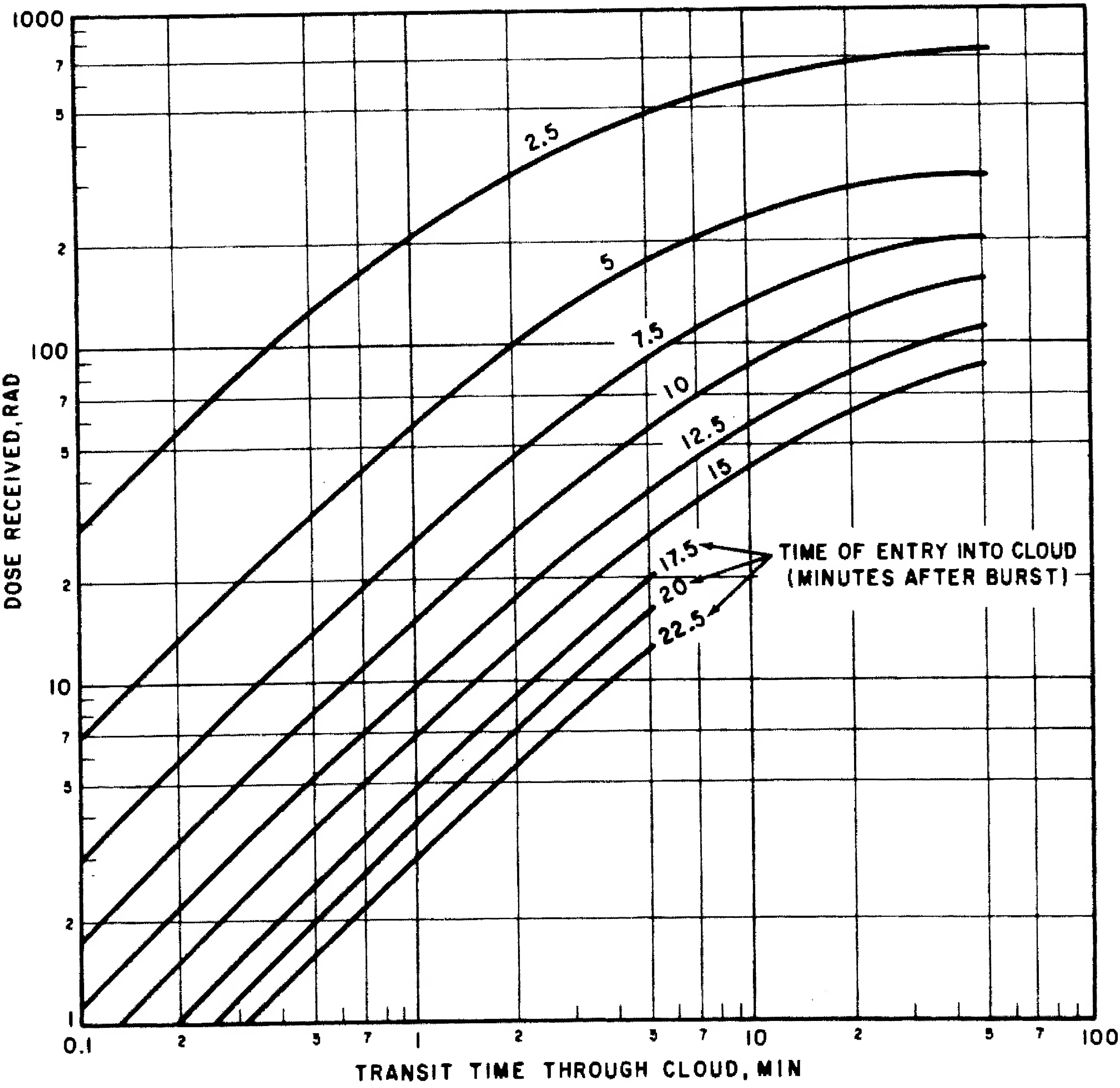

Figure 4-55. Dose Received While Flying Through a Nuclear Cloud vs. Transit Time Through Cloud

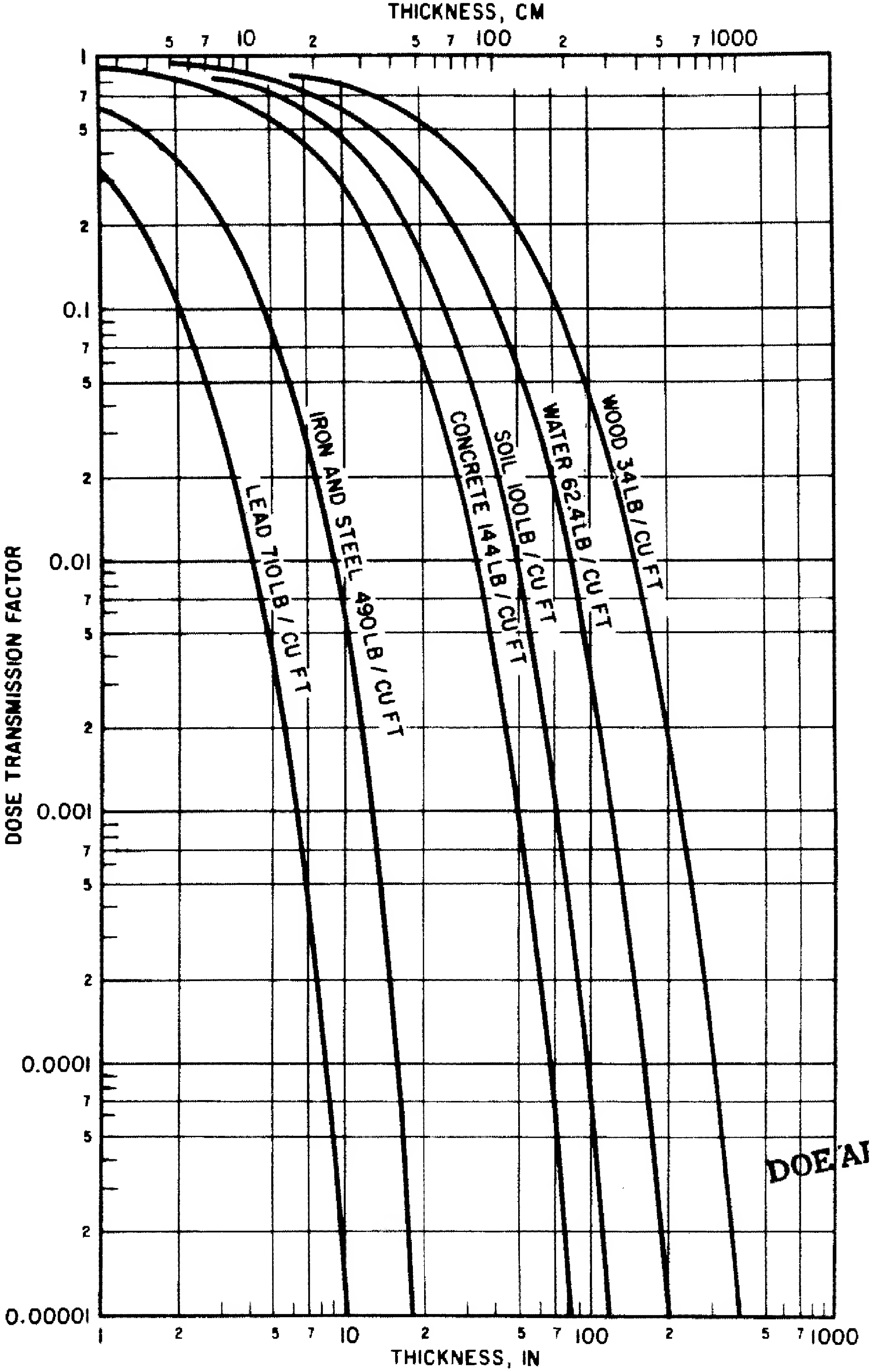

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Figure 7-11. Shielding from Initial Gamma Radiation

INITIAL GAMMA RADIATION CORRECTION FACTOR

Table 4-4 Target-burst Factors (f_{tb}) for Various Ranges of Yield and Locations of Burst and Target With Respect to Surface

Burst and Target Orientation	Air Burst Surface Target	Air Burst Air Target	Surface Burst Air Target	Surface Burst Surface Target	Sub-surface Burst Surface Target
Yield	Target-burst Factors				
Less than 400 kt	1	1.3	0.87	0.667	Obtain dose or ranges directly from figure 4-10
0.4 mt to less than 10 mt	1	1.3	1.3	1	
10 mt to 20 mt	1 (use with air-burst-surface target curves)	1.3 (use with air burst-surface target curves)	1.3 (use with surface burst-surface target curves)	1 (use with surface burst-surface target curves)	
20 mt to 40 mt	1	1.3			

Note: Extrapolation to surface burst conditions for yields greater than 20 mt and to yields above 40 mt for any burst conditions is unreliable.

Burst Location—considered an air burst when height of burst is greater than 1500 $W^{1/3}$ ft.

Target Position—considered an air target when target location is greater than 300 ft above the surface.

[redacted]

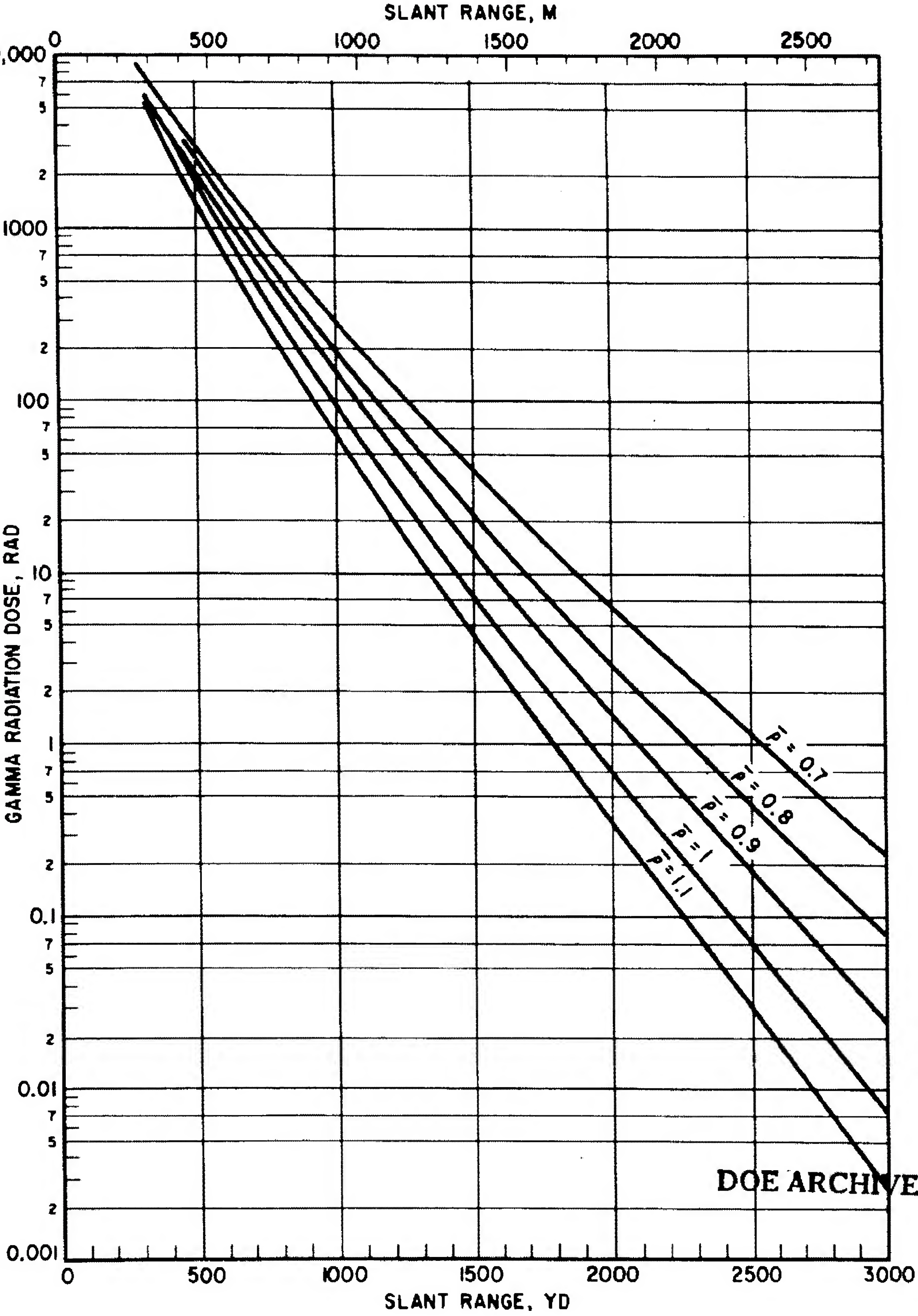

Figure 4-10. Initial Gamma Radiation Dose vs. Slant Range for Various Average Relative Air Densities, 1-kt Underground Burst, Surface Target Depth 17 ft

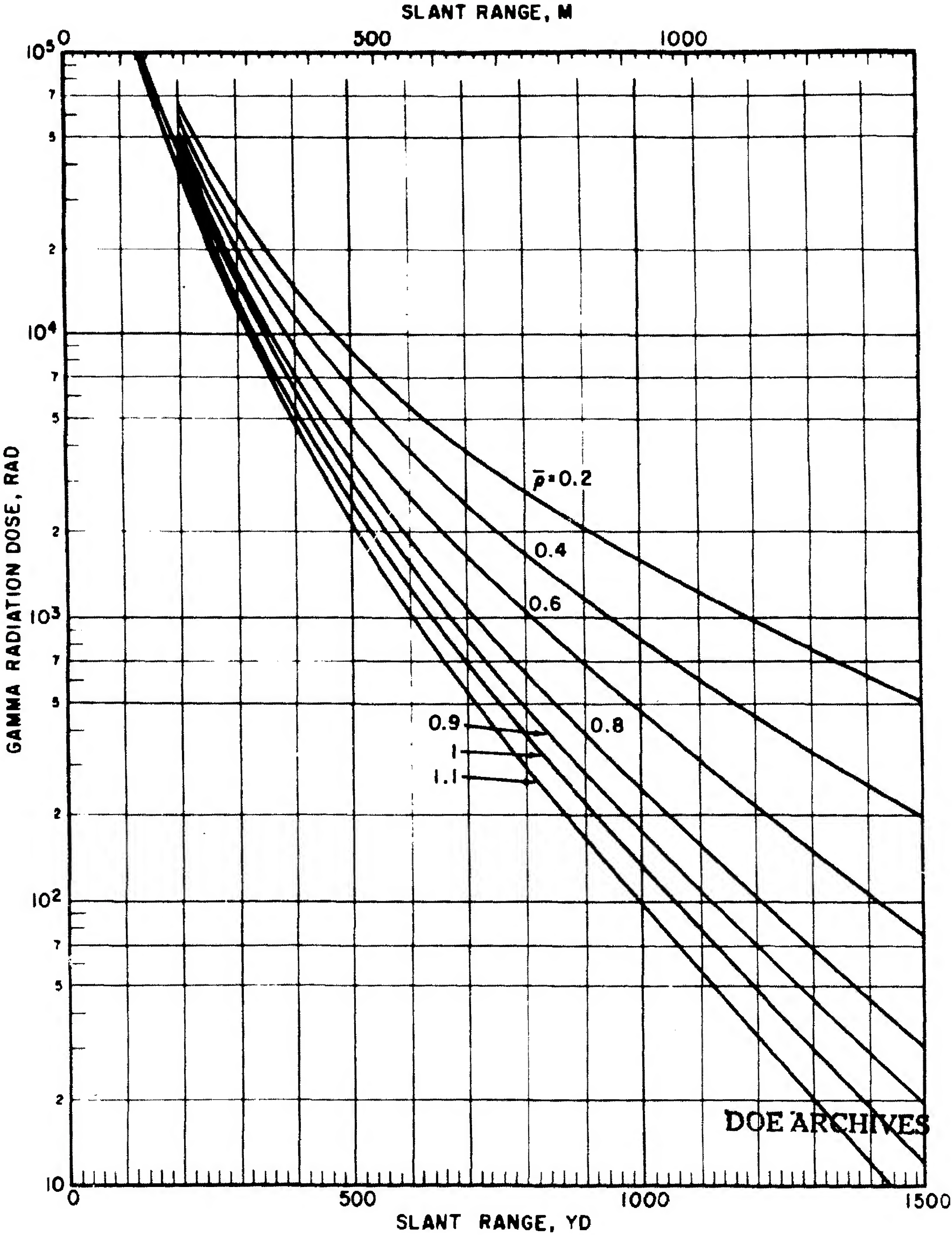

Figure 4-9(A). Initial Gamma Radiation Dose vs. Slant Range (to 1500 yd) for Various Average Relative Air Densities, 1-kt Air Burst-Surface Target

Problem 4-6 Neutron Radiation Dose

Weapon design strongly influences neutron radiation. Figures 4-17 to 4-20 are given as representative curves applicable to four general weapon categories based upon expected neutron output. Figure 4-17 applies to sub-kiloton yields and the dose is given in units of rads/ton. Figures 4-18 and 4-19 apply to average and high-flux kiloton fission weapons respectively, and the units are in rads/kt. Figure 4-20 applies to fusion weapons and the dose is given in units of rads/mt. From these curves the slant range can be determined at which a weapon of given yield will produce a specified dose; conversely, the yield required to produce a given dose at a desired range can also be found.

Several other factors will influence the dose expected at a given target location. If either the target or the burst is raised above the surface the dose can be expected to increase by approximately 50 percent. If the target is located on the water the dose can be expected to be reduced. Figures 4-17 to 4-19, curves for sub-kiloton and kiloton fission weapons, apply directly to the dose received by a land surface target from a low air burst (fireball does not touch the ground). Figure 4-20 applies directly to the dose received by a land surface target from a surface burst.

Table 4-5 Adjustment Factors for Varying Given Conditions

Condition	Factor
Target location on water surface	0.85
Target location airborne	1.5
Changing burst location from air to surface	0.67
Changing burst location from surface to air	1.5

Scaling. At a given range and relative air density, the neutron dose is proportional to weapon yield. For relative air density, see appendix B.

Example 1.

Given: A high flux 50-kt burst at 2000 ft above a water surface where the average air density between the point of burst and the target location is 0.8.

Find: The maximum neutron dose on the surface of the water at a slant range of 2200 yd.

Solution: From figure 4-19 for $\overline{\rho} = 0.8$ the dose for 1 kt at 2200 yd is 2 rads. The correction factor for the target being on water rather than on land is 0.85.

Answer: Therefore the maximum dose on the surface of the water for 50 kt at 2200-yd slant range and $\overline{\rho} = 0.8$ is $2 \times 50 \times 0.85 = 85$ rads.

Example 2.

Given: A sub-kiloton weapon burst on the ground where the relative air density is 0.9.

Find: The yield required to deliver a neutron dose of 450 rads to the outside of a bunker 500 yd from ground zero.

Solution: From the information given, figure 4-17 (sub-kiloton fission) must be used. Because the given conditions for figure 4-17 are air burst-surface target, the adjustment factor "changing burst location from air to surface—0.67" (see table 4-5) must be used to correct for a surface burst.

Answer: From figure 4-17 for $\overline{\rho} = 0.9$ read 7.2 rads/ton at 500 yd, air burst-surface target.

$$7.2 \text{ rads/ton} \times 0.67 \text{ (adjustment factor)} = 4.82 \text{ rads/ton delivered to target}$$

$$\frac{450 \text{ rads total}}{4.82 \text{ rads/ton}} = 92 \text{ tons}$$

Reliability. Depending upon weapon design, it is estimated that the dose values given in figures 4-17 through 4-20 may be low by as much as a factor of 2 for certain very high flux designs and high by as much as a factor of 5 for some older weapon designs.

Related Material. See paragraph 4-6.

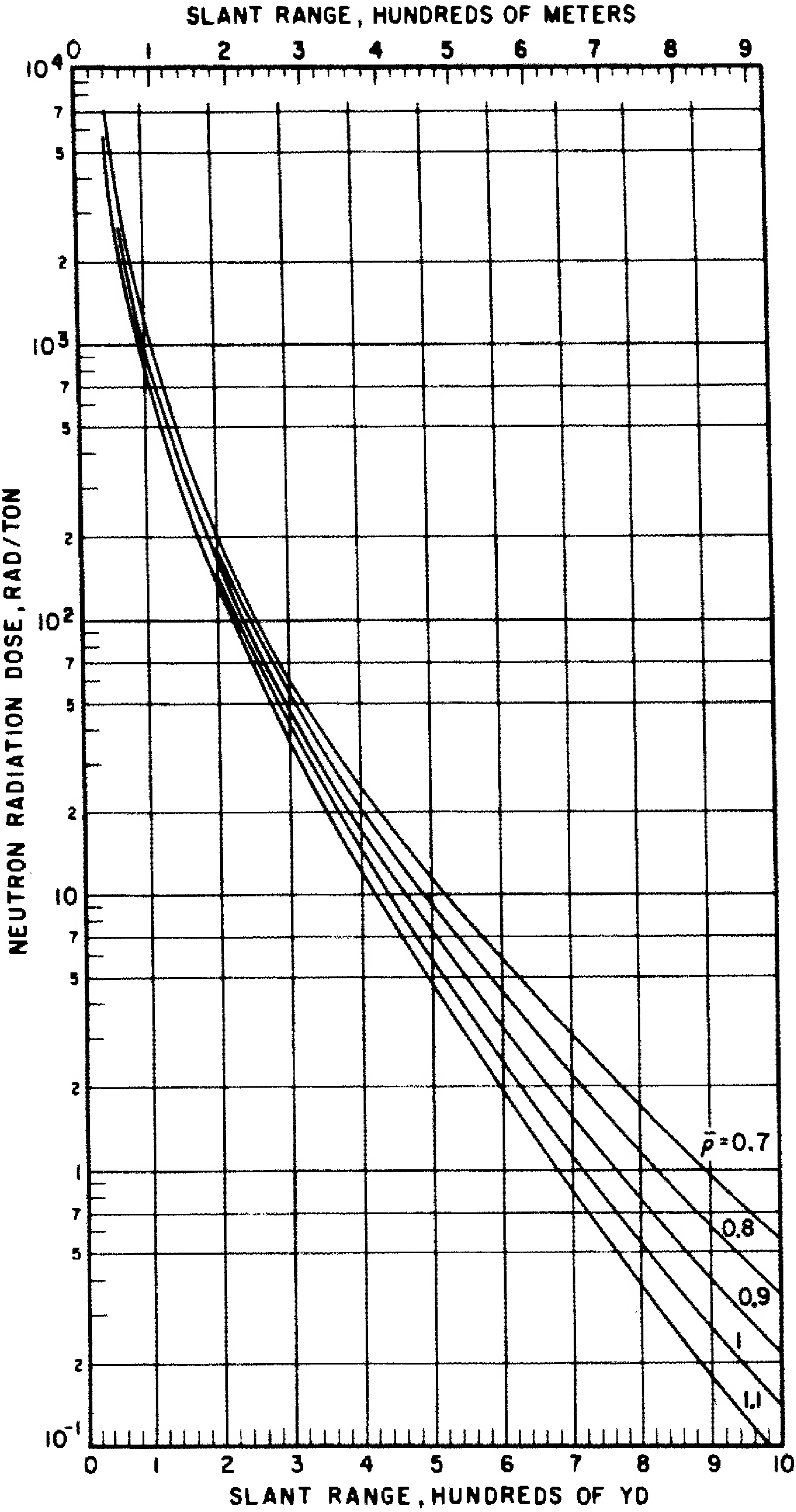

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Figure 4-17. Neutron Radiation Dose vs. Slant Range for Various Average Relative Air Densities, 1-ton (Sub-kiliton Fission) Air Burst-Surface Target

Table 4-1 Chemical Composition of Illustrative Soils

Element	Percentage of soil type (by weight)			
	Type I (Liberia, Africa)	Type II (Nevada desert)	Type III (lava, clay, Hawaii)	Type IV (beach, sand, Pensacola, Florida)
Sodium	—	1.30	0.16	0.001
Manganese	0.008	0.04	2.94	—
Aluminum	7.89	6.90	18.79	0.006
Iron	3.75	2.20	10.64	0.005
Silicon	33.10	32.00	10.23	46.65
Titanium	0.39	0.27	1.26	0.004
Calcium	0.08	2.40	0.45	—
Potassium	—	2.70	0.88	—
Hydrogen	0.39	0.70	0.94	0.001
Boron	—	—	—	0.001
Nitrogen	0.065	—	0.26	—
Sulfur	0.07	0.03	0.26	—
Magnesium	0.05	0.60	0.34	—
Chromium	—	—	0.04	—
Phosphorous	0.008	0.04	0.13	—
Carbon	3.87	—	9.36	—
Oxygen	50.33	50.82	43.32	53.332

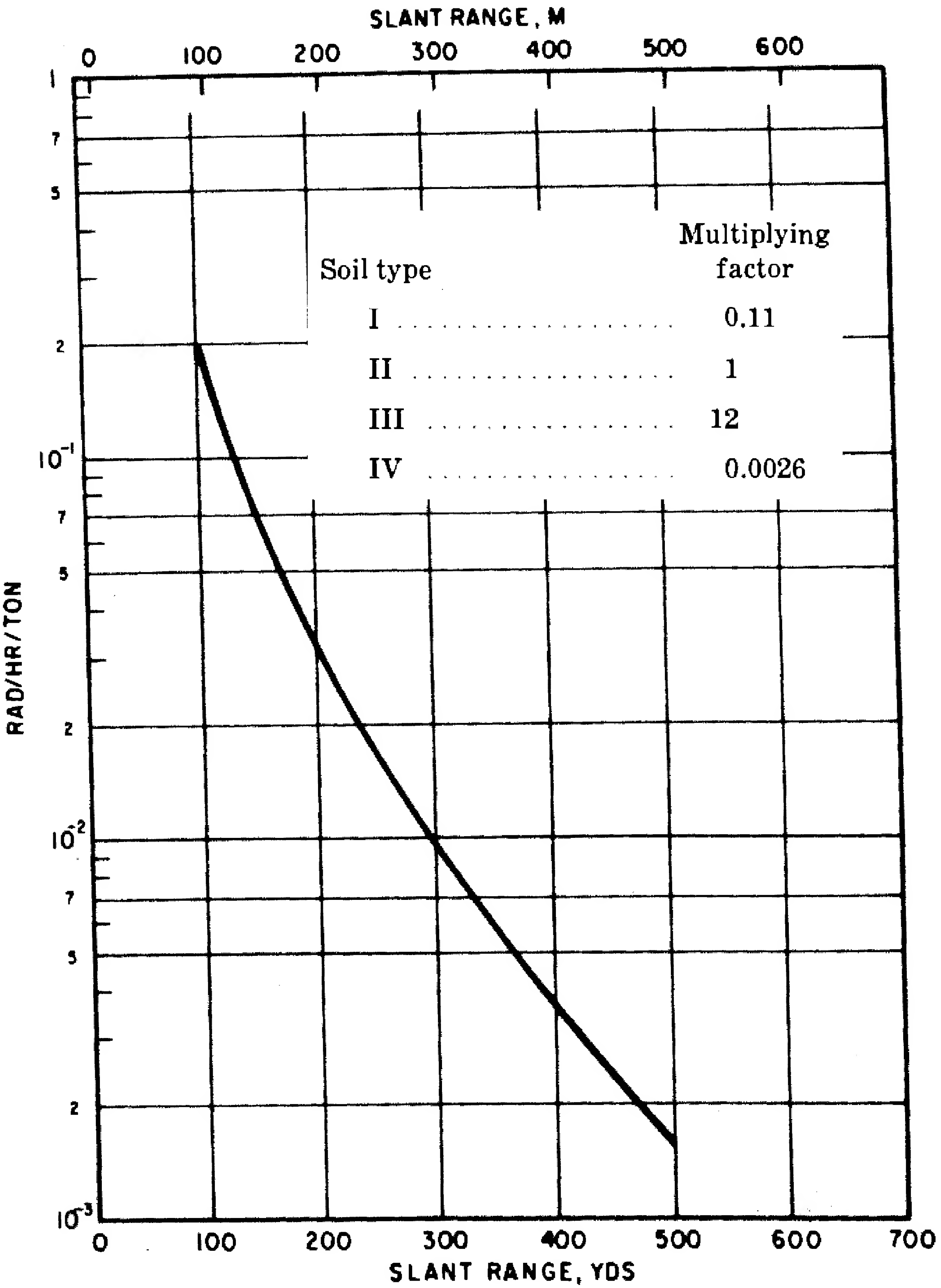


Figure 4-56. Neutron-induced Gamma Activity vs. Slant Range at a Reference Time of 1 hr After Burst, Sub-kiloton Fission Weapons per Ton

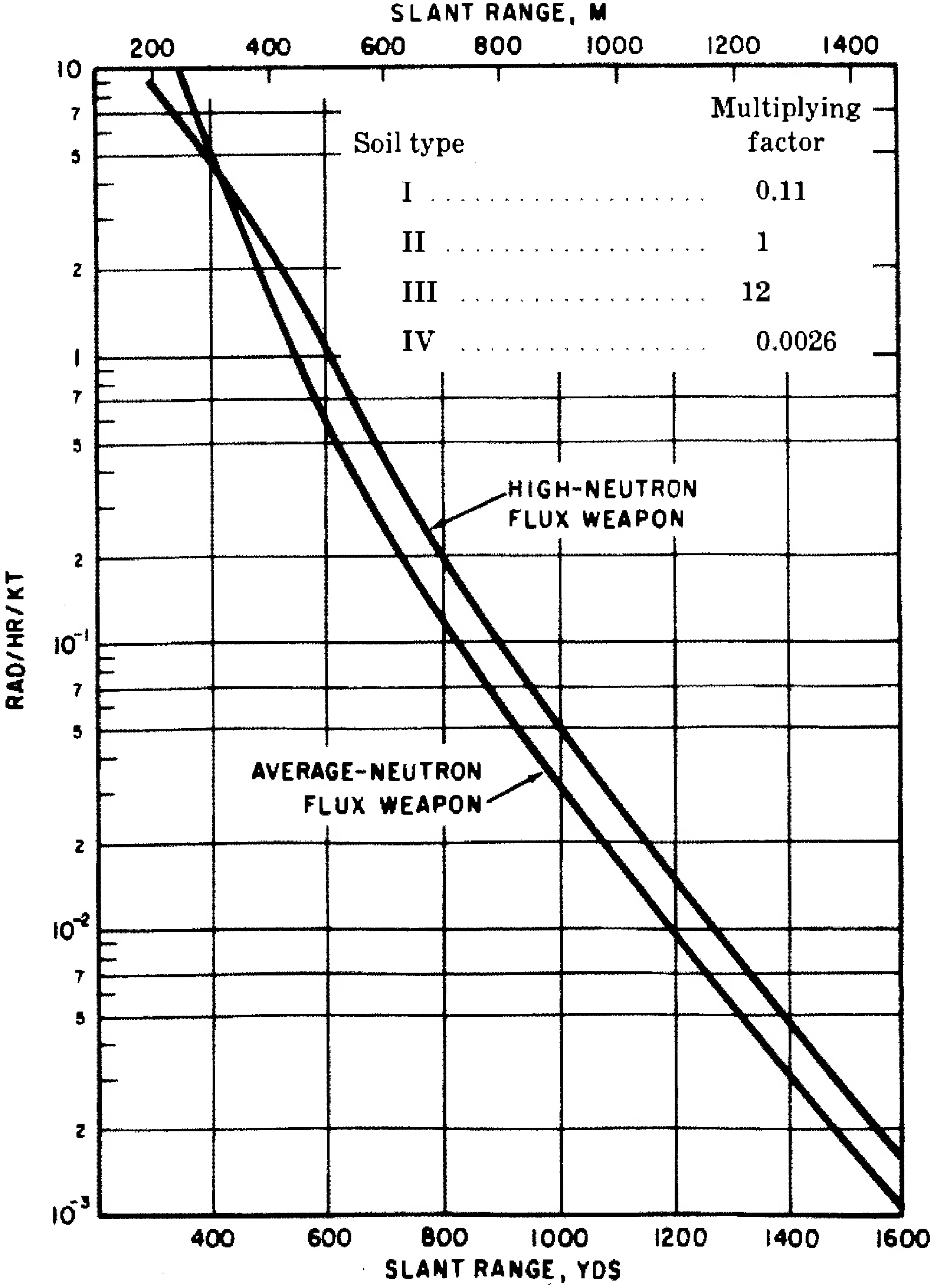


Figure 4-57. Neutron-induced Gamma Activity vs. Slant Range at a Reference Time of 1 hr After Burst, Fission Weapons per kt

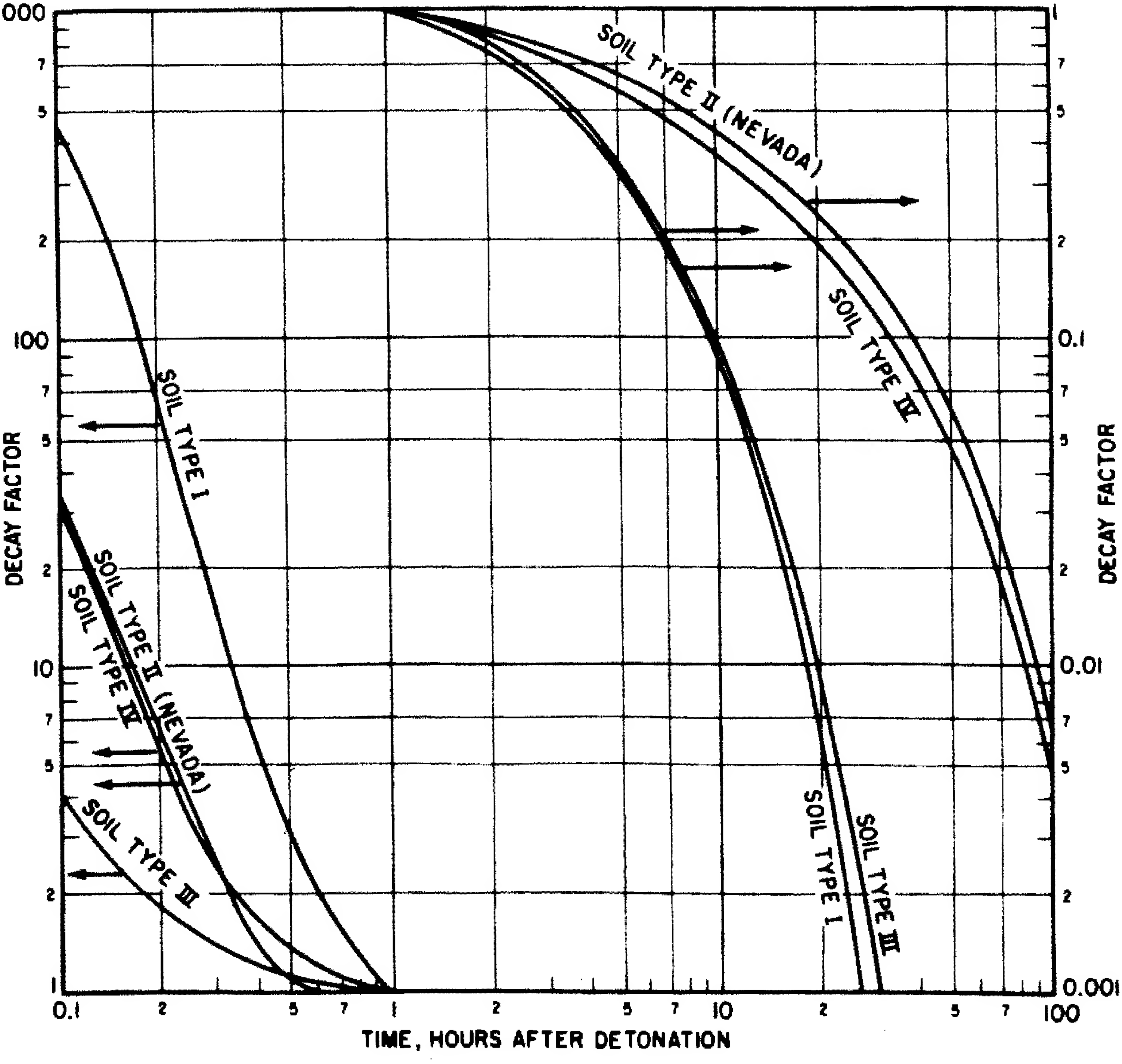


Figure 4-59. Decay Factors for Neutron-induced Gamma Activity

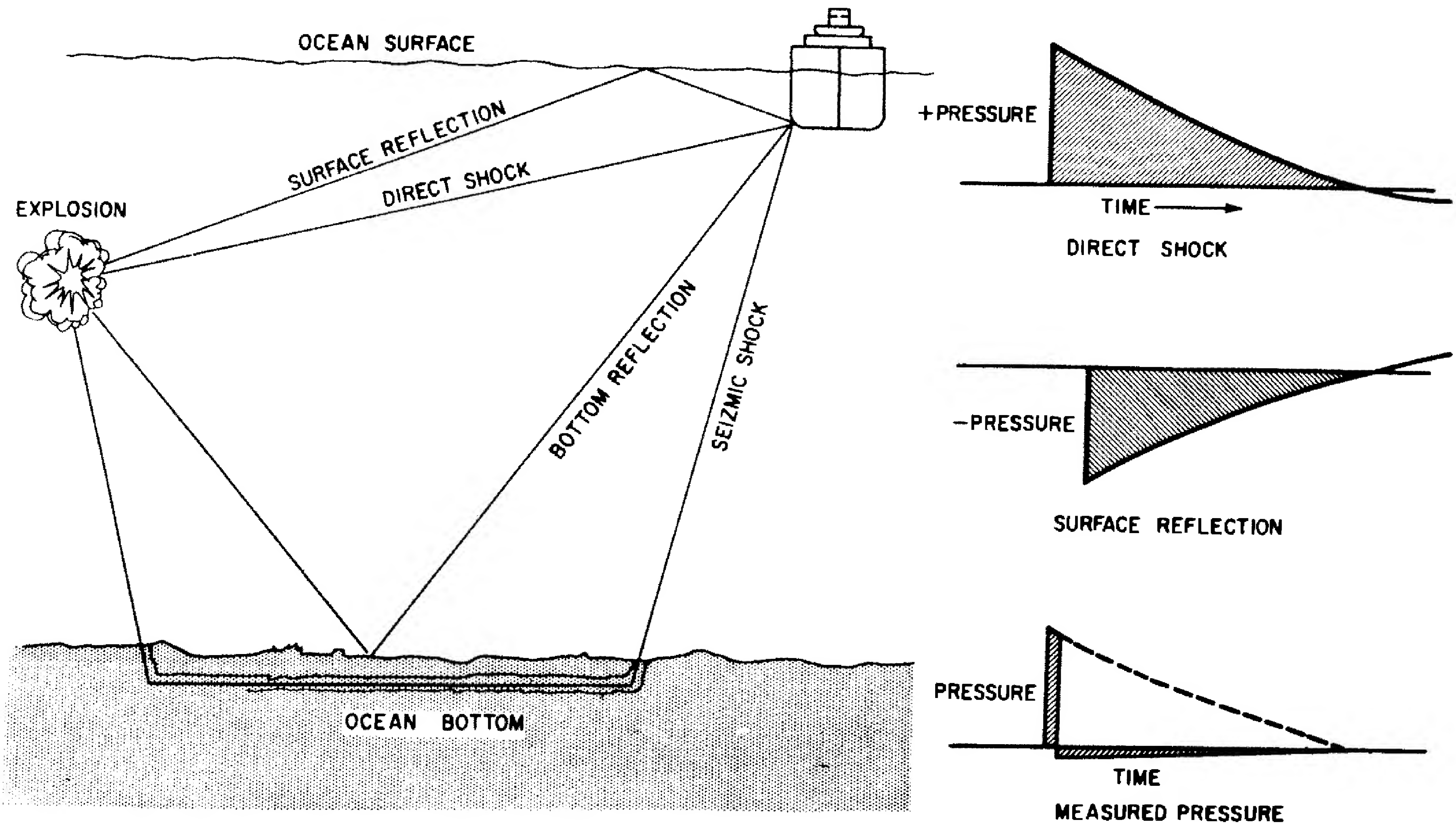


Figure 6-2. Direct and Reflected Shock Waves from an Underwater Burst

DO

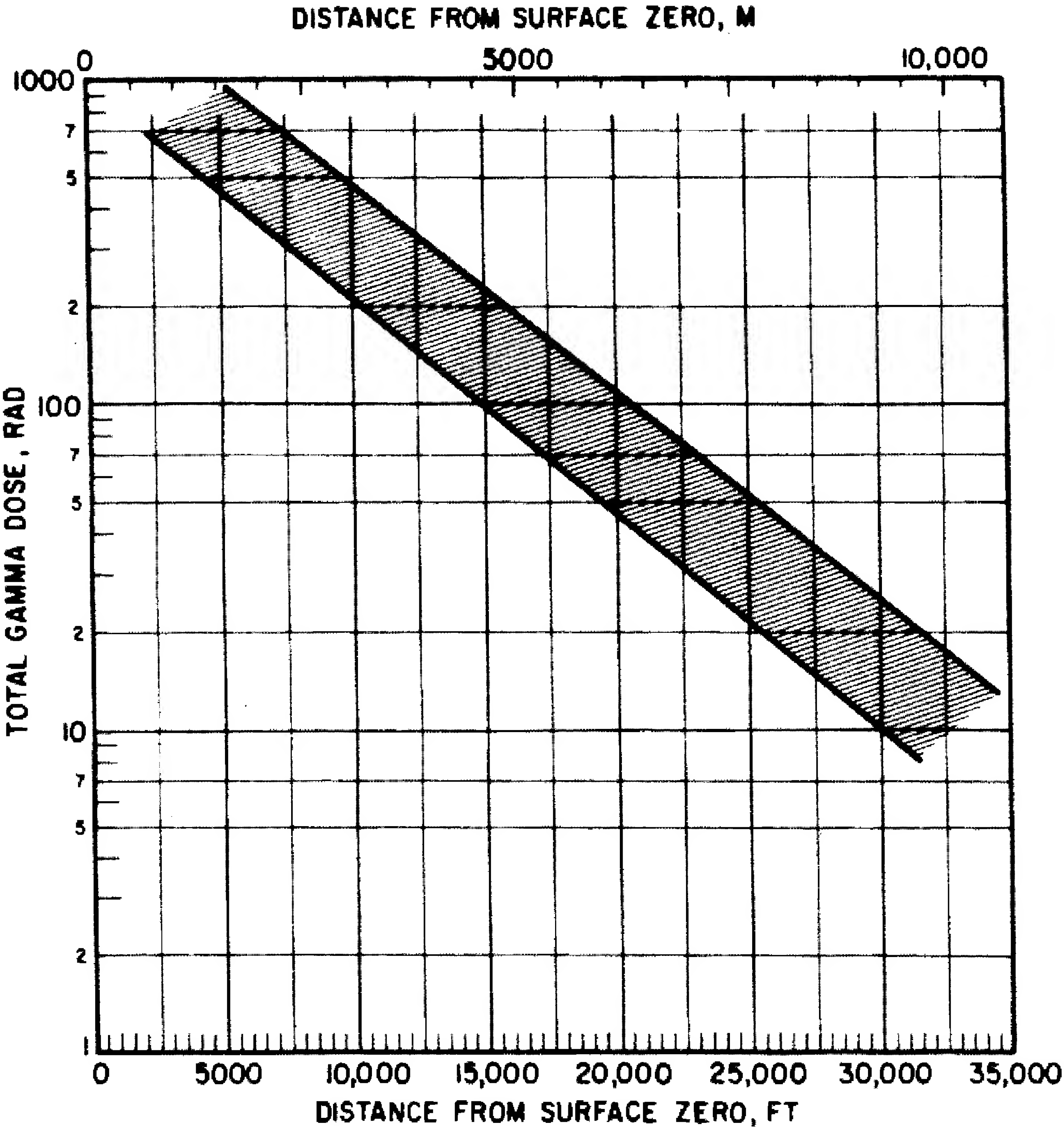


Figure 4-49. Total Dose at the Surface Downwind from a 10-kt Underwater Explosion, 15-knot Wind, Range of Burst Depths, 150 to 1000 ft

some fission products are lost along the path of migration to the surrounding water.

4-28 Fractionation. The radioactive material carried by the base surge, in most cases, fractionates in favor of those fission products having rare-gas ancestors. This probably results from scavenging of the more-refractory fission products by the early subsiding masses of water from the columns of plumes, thereby returning them to the ocean in the immediate vicinity of surface zero.

4-29 Time-space History of the Above-surface Radiation Fields. For all types of underwater explosions, the major source of radiation, to the observer on the surface, is probably the base surge, which can be extremely dangerous to any station it engulfs. Although the total quantity of fission products within the base surge amounts to some 10 to 30 percent of that initially formed, the specific activity is very high because of the early age of the radioactivity. It should be emphasized that *very close* to subsiding columns or plumes, the base surge deposits significant amounts of radioactive material on the surface causing a temporary radiological hazard. The phenomenon is almost entirely transient in nature, similar to being engulfed by a heavy fog.

Evidence to date suggests some distinct differences in the geometry of the base surge depending on whether the explosion is shallow (columns) or deep (plumes). In either case the resulting surge expands radially at a high velocity, and takes the form of a toroid for shallow explosions and is more like concentric multiple toroids for deep explosions. These differences in geometry have two effects on the time-space history of the radiation: as the single toroid passes over a station, the dose rate and dose are delivered in two increments (the forward and rear actions of the ring), as seen in figure 4-6; where concentric multiple toroids are formed, as is the case for the deep explosion, the radiation is delivered over one broad continuous increment, as shown in figure 4-7. The time of passage depends on the maximum extent of the surge periphery, the location of the observer, and the wind speed.

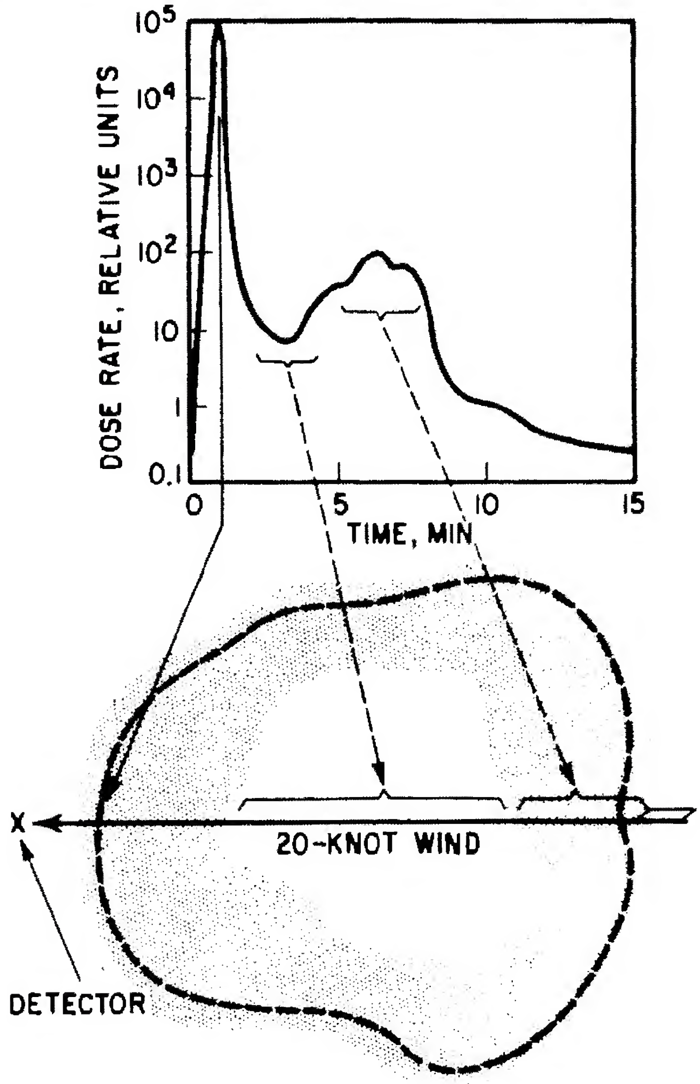


Figure 4-6. Dose Rate vs. Time for a Shallow Underwater Burst

4-30 Water Surface Shot. Nominal-yield bursts on the surface of deep water will resemble the very shallow detonation with the addition of some prompt gamma and neutron activated nitrogen in the atmosphere. For high yields such as a megaton surface burst over shallow water (less than 200 ft deep) the above-surface effects will be similar to those of a land detonation, with the cloud rising to greater heights. Probably, no base surge will develop, but the fallout likely will be different from a land surface burst, and the area of militarily significant fallout will probably be smaller. If the yield is large enough for the cloud to reach the tropopause, the cloud upon reaching this level will rise more slowly and increase in lateral dimensions more rapidly as though flattening out against a ceiling. After reaching maximum altitude, the diameter slowly increases as the cloud drifts downwind. Figure

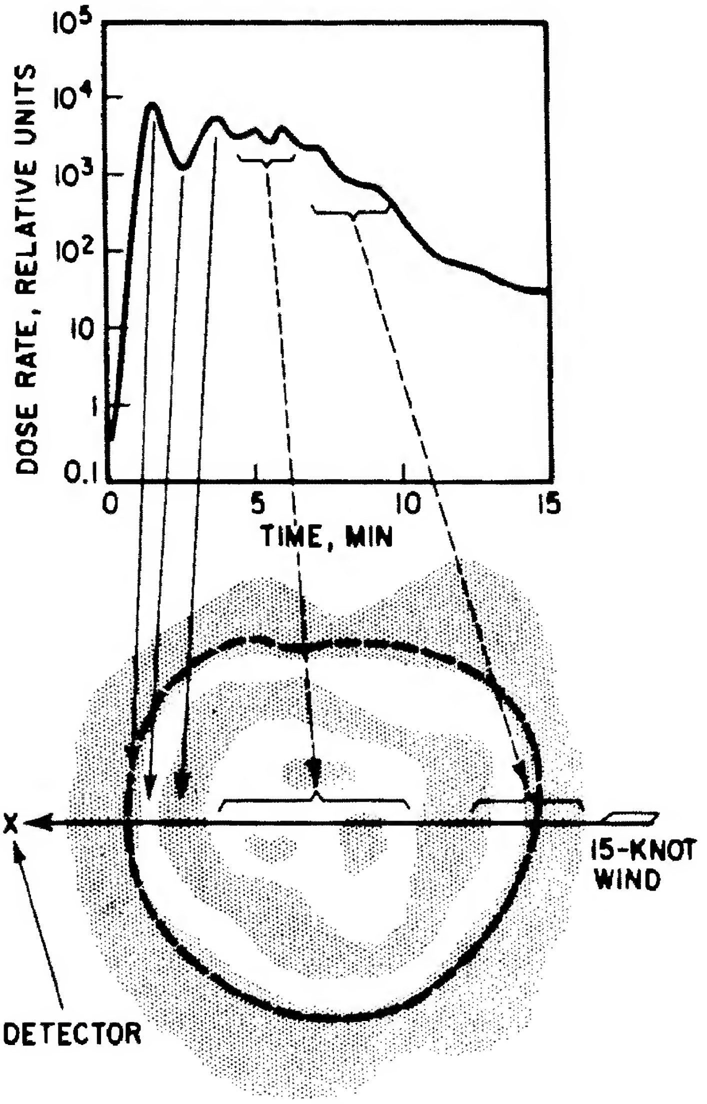


Figure 4-7. Dose Rate vs. Time for a Deep Underwater Burst

4-54 shows the cloud diameter-versus-time relationships. Figure 4-55 gives the dose received by personnel in aircraft flying through an atomic cloud at various times after the detonation.

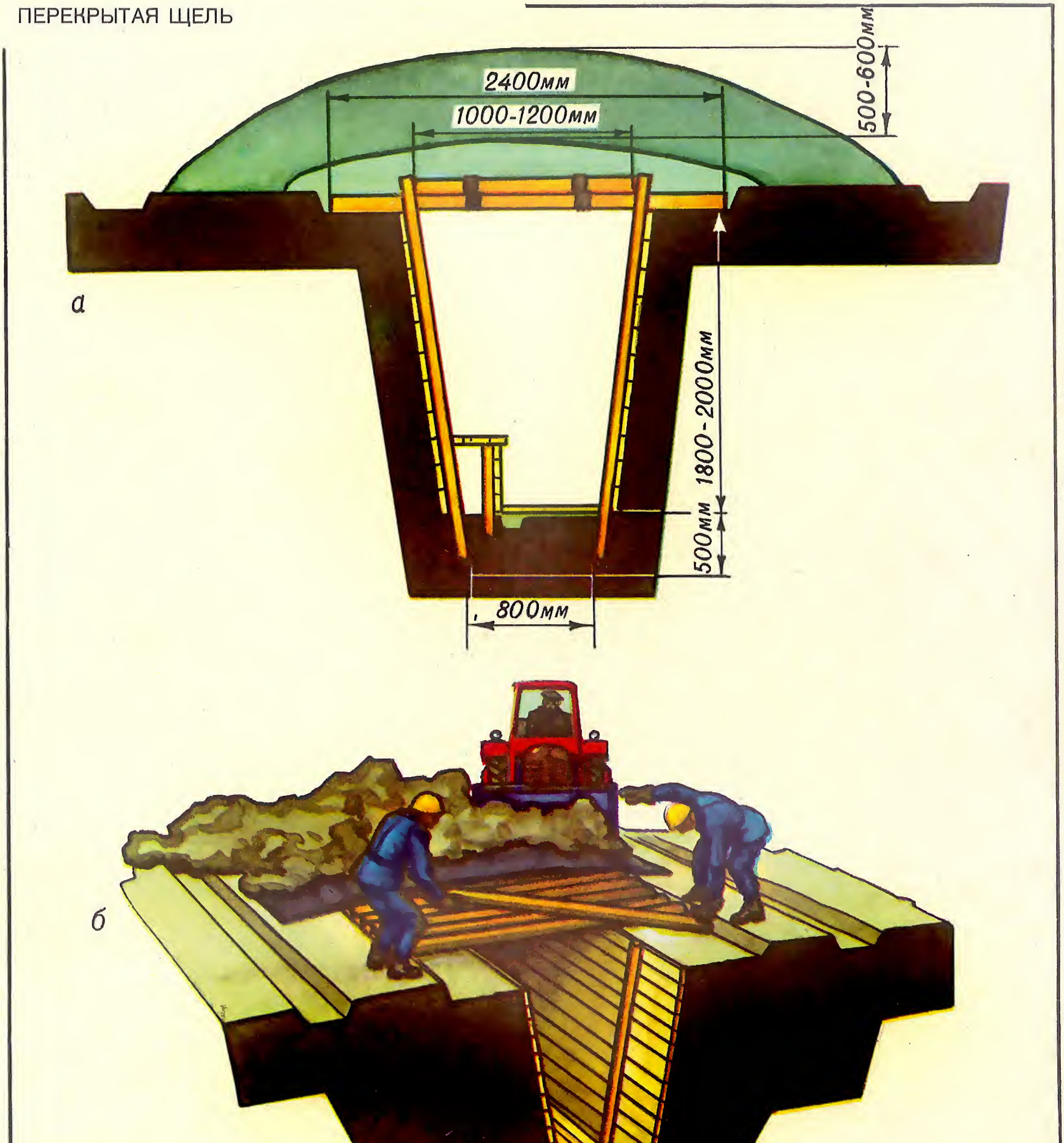
RESIDUAL BETA RADIATION

In general, the hazard due to residual gamma radiation exceeds the beta hazard for all cases except those in which intimate contact with beta-active materials occurs, as when an individual lies prone in a contaminated area, or when particles fall out directly upon the skin or scalp. For such cases, superficial burns may result, as discussed in paragraph 7-21.

SHIELDING

The dose rates obtained from the contours described, and the total doses derived therefrom, are free-field values that must be reduced if the individual concerned is protected by some shelter. Shielding factors can be estimated from the considerations stated in paragraphs 7-26 through 7-28. For example, personnel in the open in a built-up city area would receive 0.7 of the free-field dose, whereas personnel in shelter such as the basement of a dwelling would receive about 0.1 of the free-field dose.

ПЕРЕКРЫТАЯ ЩЕЛЬ

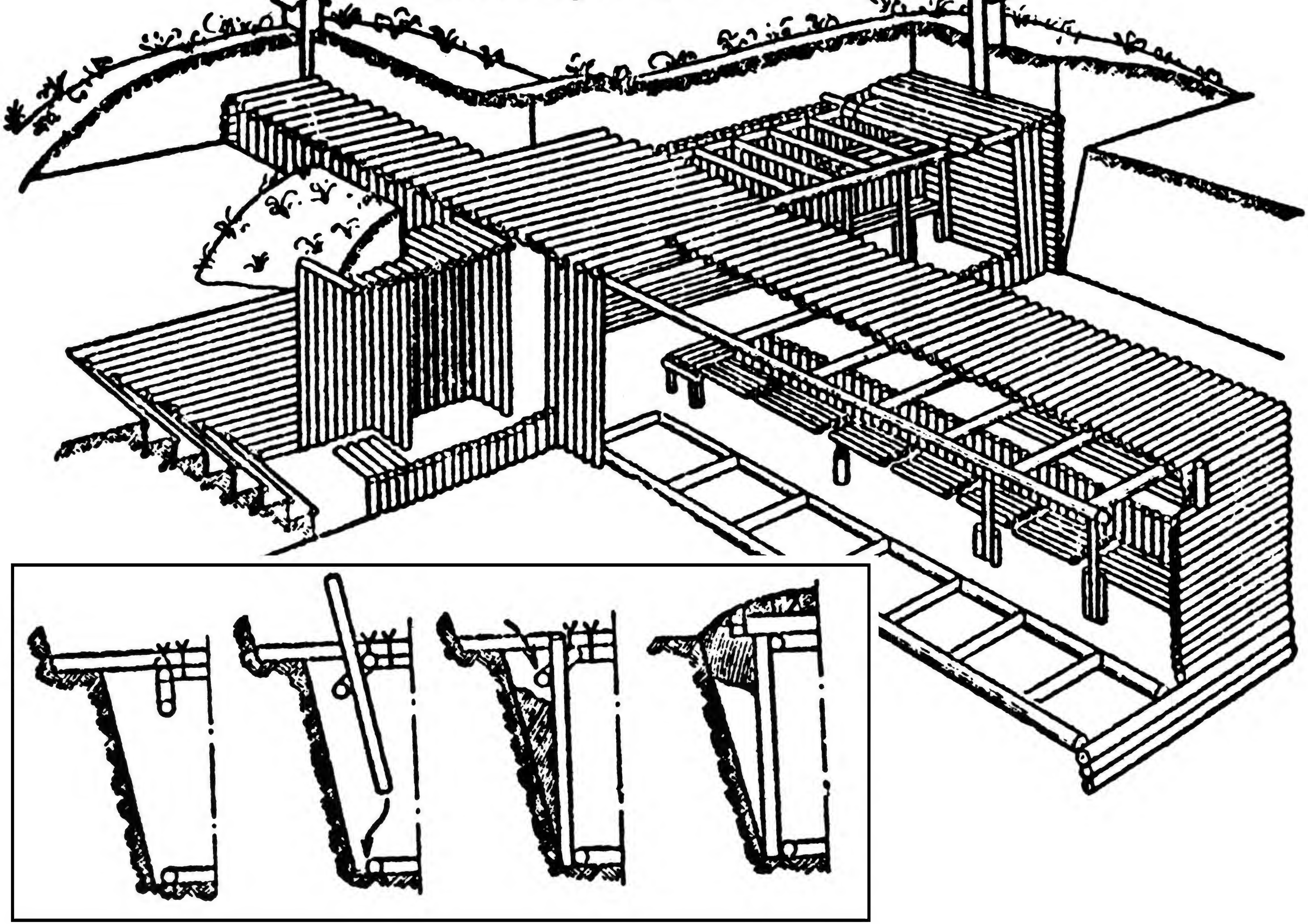


Russian nerve gas atropine injection

Russian civil defence drill

RUSSIAN CIVIL DEFENCE: GAS MASKS, RESCUE TEAMS, BASEMENT SHELTERS AND EVACUATION

Soviet design for pole shelter



MILITARY ASPECTS AND IMPLICATIONS OF NUCLEAR TEST BAN PROPOSALS AND RELATED MATTERS

HEARINGS

BEFORE THE

PREPAREDNESS INVESTIGATING SUBCOMMITTEE

OF THE

COMMITTEE ON ARMED SERVICES UNITED STATES SENATE

EIGHTY-EIGHTH CONGRESS

FIRST SESSION

PART 1

MAY 7, 15, 28; JUNE 5, 25, 26, 27; AUGUST 1, 2, AND 9, 1963

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which this testing has been done concurrently overseas and within the United States. The first events commenced and completed were underground tests. These consisted of, as you can see here, the Hard Hat event, the Danny Boy shot, and Operation Marshmallow.

In addition, the other four events which occurred at the Nevada test site—The Little Feller II shot—the Danny Boy test, which is a crater and ground shot experiment, the Small Boy test, which comprised a great number of projects which I will go into more detail a little later, and, finally, the Little Feller I shot [deleted].

I will attempt to provide a synopsis of the most significant results of these tests, in terms of the requirements we have previously stated.

The five shots that occurred in the Pacific in the effects area were all high altitude. We did one underwater test which was to evaluate underwater effects for the safe delivery or safe standoff distance for delivery systems in delivering nuclear weapons.

CONTINENTAL TESTS

Test	Purpose	Yield (kilotons)	Date
Underground:			
Hard Hat	Underground structures	5.9	Feb. 15, 1962
Danny Boy	Cratering	.43	Mar. 5, 1962
Marshmallow	[Deleted]	[Deleted]	June 28, 1962
Atmospheric:			
Little Feller II	[Deleted] effects	[Deleted]	July 7, 1962
Johnie Boy	Cratering	.5	July 11, 1962
Small Boy	[Deleted]	[Deleted]	July 14, 1962
Little Feller I	[Deleted] effects	[Deleted]	July 17, 1962

PACIFIC TESTS

High altitude:			
Star Fish	400 kilometer effects	1,450	July 9, 1962
Check Mate	[Deleted] effects	[Deleted]	Oct. 20, 1962
Blue Gill	[Deleted] effects	[Deleted]	Oct. 26, 1962
King Fish	[Deleted] effects	[Deleted]	Nov. 1, 1962
Tight Rope	[Deleted] effects	[Deleted]	Nov. 4, 1962
Underwater: Sword Fish	Underwater effects	13.5 CLASSIFIED IN 2015!	May 11, 1962

DEFINITION OF HIGH ALTITUDE

Senator SALTONSTALL. High altitude is about how high?

Colonel CLINTON. We usually think of high altitude being anything above the altitude normally associated with airplane flight, sir.

Most of our high-altitude shots have been from 20 kilometers on up. We have done some lower altitude shots that have been in the atmosphere, which we have done by balloons. We generally think of high-altitude tests as being those tests above manned aircraft.

Senator THURMOND. What elevation is that, Colonel?

Colonel CLINTON. Fifty thousand feet, sir, on down. Normally I would say we would think of anything above 50,000 feet—I believe we would consider that a high-altitude shot.

Senator STENNIS. All right, proceed.

Colonel CLINTON. I will attempt to discuss some of the results which we obtained from the tests in the last series.

The first of these is the vulnerability of hardened sites to both blast and shock effects [deleted]. These are the [deleted] major phenomena to which are hardened sites [deleted] are vulnerable. [Deleted]

Yesterday, as you know, we had Admiral Anderson before us. He presented the statement that represents the joint views of the members of the Joint Chiefs.

I nevertheless think that it is important for you to testify personally in addition thereto.

You refer to the views expressed in the joint statement, and you concurred in that statement, is that right?

TESTIMONY OF GEN. CURTIS E. LeMAY, CHIEF OF STAFF, U.S. AIR FORCE; COL. OLA P. THORNE, ASSISTANT FOR NUCLEAR ENERGY TO THE DEPUTY CHIEF OF STAFF, RESEARCH AND DEVELOPMENT, U.S. AIR FORCE; FRANK H. PEREZ, CONSULTANT ON ATOMIC ENERGY MATTERS TO THE ASSISTANT CHIEF OF STAFF, INTELLIGENCE, U.S. AIR FORCE, ALSO AIR FORCE MEMBER OF THE JOINT ATOMIC ENERGY INTELLIGENCE COMMITTEE; AND LT. COL. CHESTER A. SKELTON, ARMS POLICY BRANCH, DEPUTY CHIEF OF STAFF, PLANS AND OPERATIONS, U.S. AIR FORCE

General LEMAY. Yes, sir; that is right.

Senator STENNIS. You have filed a very strong supplementary statement. I believe it will expedite the matter if we can let the general read his statement now and read it in its entirety. Then we can ask questions.

All right, General, will you proceed in your own way?

LE MAY STATEMENT

General LEMAY. Mr. Chairman and members of the committee, the views of the members of the Joint Chiefs of Staff on a proposed nuclear test ban treaty were presented by Admiral Anderson on June 26, 1963. The agreed joint statement was submitted for the record .

I shall not elaborate further on the views presented in the agreed statement. However, I should like to repeat for emphasis that it is the judgment of the Joint Chiefs of Staff that the proposed test ban treaty is not adequate to prevent the Soviet Union from making important advances in nuclear weaponry [deleted]. We have concluded that the proposed treaty is not consistent with the national security.

At this time I should like the opportunity to discuss with you my views on the military implications of a nuclear test ban. [Deleted.]

If we expect to maintain military superiority, as the situation exists today, we must do two things: (1) continue to expand our understanding of weapon effects, and (2) continue to improve our military capabilities through the development and application of new weapon techniques. Nuclear testing is necessary for both of these objectives. To put it in another way: continuing, substantial progress in our nuclear technology is essential if we are to maintain the military capability necessary to support our overall foreign policy objectives. Testing is essential for such progress.

Some advance in nuclear technology can be made without testing, but the rate is unacceptably slow. This fact was brought home to us solidly by the 1958, self-imposed moratorium. We attempted to maintain our laboratories at a readiness-to-test capability; and we dis-

At sea level, the radiation dose from cosmic radiation far exceeds that from fallout; at higher elevations (Denver, Colo., 5,000 feet), cosmic radiation contributes an even greater fraction of the total body dose.

Fear of the unknown is played up by cartoons, propaganda, half-truths and misinformation as to the effects of fallout. I do not wish to imply that fallout cannot be a hazard; however, with proper precautions, such as those taken by the AEC, the hazard is minimized. A good public information program could allay most of the present concern. It is clear that effects from fallout are far less dangerous to our people, and the people of the free world, than the risks of Russian predominance in the nuclear weapons field.

Unless we are willing to undertake our testing program enthusiastically, and to expend the necessary effort and resources to insure a positive U.S. superiority in all of the critical nuclear areas, the Soviets stand to gain a clear margin of nuclear superiority vis-a-vis the United States. In the current world environment, preserving peace means maintaining preponderant military power. To maintain a favorable balance of military power we must have nuclear superiority. To do this I firmly believe we must continue our nuclear weapon development programs and be able to conduct nuclear testing as required.

WHETHER TESTING IS NECESSARY TO MAINTAIN U.S. SUPERIORITY

Senator STENNIS. General, may I ask a few questions now based on your supplemental statement?

In the first part of your statement you say, and I am paraphrasing, that testing is essential for progress; and testing is also necessary to maintain our military superiority.

Now my question is this: Is this still true even if Russia should, under agreement, actually stop testing?

Suppose there should be a treaty and it should be observed and Russia actually stopped testing. Would our position then become inferior? Would parity result or would your statement hold true if there should be agreement?

General LEMAY. If both sides agreed to stop testing now, and the Russians abided by the agreement, they would certainly be ahead of us in the high-yield weapons. We are sure of that.

They are probably ahead of us in the [deleted] range. [Deleted.]

While there seems to be general agreement [deleted] that we are probably still ahead in the low-yield range, I am not so sure that we have enough information to support this view.

It seems to me that at the time the Soviets decided to go ahead with their very comprehensive test program, they probably planned to test across the spectrum. They may have concentrated on high-yield tests; however, I believe it is prudent to assume that they went clear across the spectrum of yields. [Deleted.]

Senator STENNIS. So, regardless of the situation at the lower yields, you feel sure that from [deleted] upward they have a present superiority which, of course, they would maintain if all testing were stopped by both sides, is that correct?

General LEMAY. I think that is correct; yes, sir.

TOP SECRET

B.F with other Min
11/3

5th March, 1953.

Dear Montague-Browne,

With reference to my letter of 4th March about the article in the Daily Telegraph on searching of ships for atomic bombs, my attention has now been called to the fact that Sir Norman Brook sent a minute to the Prime Minister on this subject dated 28th March 1952, enclosing a copy of a paper headed "Clandestine Use of Atomic Weapons".

I had not realised when I wrote to you that Sir Norman Brook had been handling this question. I suggest that in the circumstances it would be better not to put my letter to the Prime Minister until Brook has had an opportunity of considering the matter further in the light of recent developments. I will let you know as soon as I can whether or not we would like the letter to go forward.

Yours sincerely,

[signature]

Sir N. Brook's minute now submitted

AMB
10/3

A.A.D. Montague-Browne, Esq., D.F.C.

TOP SECRET

PRIME MINISTER

You have drawn the attention of the Ministry of Defence to an article about Atom Bomb Checks by American Coast Guards, which appeared in the Daily Telegraph on February 27. — flag A

flag 'B' I made a submission to you on this subject on March 28, 1952, when I sent you a copy of a minute which I had sent to Mr. Attlee in July, 1951. I said then that I believed the risk that an enemy might explode an atomic bomb in a ship in one of our ports was one against which we could not at present take any effective precautions. Recently, however, we have heard that the Belgians and the Dutch - as well as the Americans - are claiming to have introduced precautions of some sort. We are now finding out more about these; and, when this information is available, I will make a further submission to you on the question whether we should review our own position again.

Duplicate initd and returned.

12/3.

12.3

Norman Brook.

MARCH 9, 1953

R.

EXTRACT FROM "THE DAILY TELEGRAPH"

27/2/53. page 7:

ATOM BOMB CHECKS
1,500 Ships Searched

Rear-Adml. Richmond, Assistant Commandant of the Coast Guard Service, revealed to-day that Coast Guards were regularly searching vessels approaching ports such as New York for atomic bombs, other types of explosive and bacteriological weapons. More than 1,500 ships had been searched during the past two years.

At present 30-40 vessels are being searched monthly, most of them from Iron Curtain countries. "So far," added the Admiral, "we have found nothing that resembled explosive."

Tube Alloys
Clandestine use of weapons
Part 2

G.R. TOP SECRET

PRIME MINISTER

At the "Apex" Committee on Wednesday you asked me to let you have a report on the risk that an enemy might explode an atomic bomb in a ship in one of our ports and on difficulties of countering this risk.

I attach the report below on this question which I submitted to Mr. Attlee in July, 1951. As you will see, the Chiefs of Staff had then asked me to arrange to have the matter further considered by the civil Departments concerned; but I had come to the conclusion that matters could not be advanced further by this means and I suggested that Mr. Attlee should discuss the problem with the Foreign Secretary and the Minister of Defence. This he was unable to do before the Election. Since then I have taken no further initiative to raise the matter since I myself believe that this is a risk against which we cannot at present take, in normal times, any effective precautions.

Norman Brook.

R. 28th March, 1952

TOP SECRET

PRIME MINISTER

Clandestine Use of Atomic Weapons

The Chiefs of Staff have been considering the possibility that the enemy might open the next war with an atomic attack on London on the model of the Japanese attack on Pearl Harbour - without warning and before any formal declaration of hostilities. The most effective method of making such an attack would be to drop an atomic bomb from a military aircraft. If the control and reporting system were fully manned and alert in a period of tension, there would be some chance that hostile aircraft approaching this country could be intercepted and driven off. At any rate, there are no special measures, outside the normal measures of air defence, which we could take in peace-time to guard against this type of attack.

2. It is, however, possible that the enemy might use other means of surprise attack with atomic weapons. A clandestine attack could be made in either of the following ways:-

(i) A complete atomic bomb could be concealed in the hold of a merchant ship coming from the Soviet Union or a satellite country to a port in the United Kingdom:

(ii) An atomic bomb might be broken down into a number of parts and introduced into this country in about fifty small packages of moderate weight. None of these packages could be detected by instruments as containing anything dangerous or explosive, and even visual inspection of the contents of the packages would not make identification certain. These packages could be introduced either as ordinary merchandise from Soviet ships, or possibly as diplomatic freight. The bomb could subsequently be assembled in any premises with the sort of equipment usual in a small garage, provided that a small team of skilled fitters was available to do the job.

3. It is difficult at any time to take practical and effective measures against this type of danger. It would be less difficult, of course, in a period immediately before the outbreak of a war which the

public had come to regard as inevitable - the period which we call the Precautionary Stage. But the enemy might prefer to make such a move in a period of comparative calm, when he might assume that less attention would be paid to security risks of this kind.

The only possible measures which could be taken to reduce this risk are control of shipping and closer supervision of diplomatic freight.

Control of Shipping

4. For effective security against this risk all suspect shipping would have to be kept at least 5,000 yards distant from any worth-while target - e.g. from London, Liverpool, Glasgow, Southampton, Bristol and Hull. There are in theory four possible ways of doing this:-

(a) Trade Attraction. All Russian ships carrying bulk cargoes on Government account could be diverted to minor ports, by specifying that that was where the consignee desired delivery of the goods. This would be regarded as discrimination against Russian ships and would invite inconvenient reprisals. It would be expensive. And it would not cover Russian ships carrying cargo ordered on private account.

(b) Diversion by Order. The Admiralty could take power to regulate the movements of all vessels, as they had in the war under Defence Regulation 43. They could then divert all ships of any kind suspected of carrying Russian cargo to minor ports. By a liberal use of this power, the diversion could be made effective; but the discrimination against Russian and satellite shipping would be so blatant that it might well end in the complete stoppage of all trade with the Iron Curtain countries.

(c) Off-shore Discharge. All Russian, Polish and Roumanian ships approaching the major ports could be instructed to discharge their cargoes at off-shore anchorages. This method would lead to retaliation. Moreover, it is hardly practicable; for grain is the main commodity carried by Russian ships and we do not possess the floating elevators which would be necessary for off-shore discharge of grain cargoes at all major ports.

(d) Port and Transit Control. In the Precautionary Stage we propose to introduce a scheme by which all ships approaching the country would be met and escorted to determined ports and anchorages. Under this control

suspect ships could be diverted away from the main target areas; but the control would only be practicable in the Precautionary Stage when there would be a much reduced volume of United Kingdom and Allied shipping, and enemy shipping would be likely to keep as far away as possible from United Kingdom ports. It would be impracticable to bring this system into force at a time of normal trade with Russia and satellite countries.

5. Any action of the kind discussed in the preceding paragraph would involve some element of open discrimination against the Soviet Union; it would invite retaliation in some form; and it would probably have serious political and economic consequences. Moreover, even if those consequences could be accepted, this type of action could not completely exclude the risk. For even, if it were possible by this type of action to keep all Russian, Polish and Roumanian ships away from the main target areas, the enemy could, if he were so minded, defeat all these precautions by chartering an innocent-looking ship of another flag and using it for a clandestine atomic attack or by placing his bomb in crated merchandise consigned to this country by a neutral vessel normally trading to a U.K. port.

Supervision of Diplomatic Freight

6. If the enemy wished to introduce an atomic bomb into this country in parts and assemble them here, as suggested in paragraph 2(ii) above, the parts would probably be consigned to the Soviet Embassy in London as diplomatic freight. A foreign Embassy has an absolute right to receive by diplomatic courier correspondence which is exempt from any examination by the territorial authorities. It has a further right to import certain things without paying Customs duty, but the territorial authorities are entitled to verify that diplomatic freight and diplomatic bags are not being abused as a method of importing things which are neither documents nor things which the Embassy has a right to import without paying Customs duty. It would therefore be permissible for us to open the Soviet diplomatic bag or to examine diplomatic freight for this purpose, provided that this were done in the presence of a member of the Soviet Embassy and that no attempt was made to open seals on any documents in envelopes. There would, however, be serious risks in doing so. We should invite immediate reprisals, which might involve widespread interference with our arrangements for supplying our own diplomatic missions behind the Iron

Curtain. In an exchange of discourtesies like this, we should normally have more to lose than to gain. Action of this kind could not fail to increase international tension. These disadvantages are certain. The gain, on the other hand, would be problematical; for we understand that, even if packages were opened and subjected to expert inspection, it could not be established with certainty that the contents were not parts of an atomic bomb.

7. Although it may be impracticable to prevent the importation of parts of an atomic bomb into this country, whether as diplomatic freight or otherwise, it is just possible that we might be able to detect the preparation for its assembly. This process would probably be directed and controlled through the Soviet Embassy in London, and it might be possible by increased vigilance to detect suspicious movements of vehicles to and from the Embassy. That is a point which we should like to examine further. It is of course by no means certain that we should be able by this means to secure, until it was too late, any positive indication that a bomb was being assembled here.

Conclusion

8. It is clear that it would be practicable for the Russians to introduce an atomic bomb into this country by clandestine methods. It is equally clear that there is no certain method of preventing them from doing so. The most that we could secure, by taking any of the measures discussed in this minute, would be to make their task more difficult. And the adoption of any of these measures would involve considerable risks and serious political and economic difficulties. This being so, it seems legitimate to ask whether the Russians would think it worth while to adopt these elaborate clandestine methods of launching an atomic attack when a military aircraft might do the job more effectively for them. An even larger question is whether the Russians would think it was worth their while to invite immediate retaliation by atomic attack against themselves so long as the advantage in numbers of atomic bombs remains overwhelmingly with the Americans.

9. The Chiefs of Staff have already arranged for an official working party (comprising representatives of the interested civil Departments) to consider means of guarding against this risk, and the possible

counter-measures discussed in this minute were all suggested in the report of this working party. The Chiefs of Staff have now asked me to arrange for further Departmental examination of these proposals and for any necessary submission to Ministers. For the reasons indicated in this minute I am very doubtful whether the increased security which might be obtained by adopting any of these measures could outweigh the very serious disadvantages, political and economic, which would be entailed. I have therefore thought it desirable to seek your guidance in the matter before asking Departments to undertake the work of assessing those disadvantages. You may like to discuss the problem with the Foreign Secretary and the Minister of Defence; but I suggest that, for the moment, it would be preferable that it should not be discussed in any wider group of Ministers.

(Signed) NORMAN BROOK

12th July, 1951

THE EFFECTS OF HIGH-YIELD NUCLEAR EXPLOSIONS

Statement by

Lewis L. Strauss, Chairman

and

A Report by

The United States Atomic Energy Commission

February 1955

PROTECTION AGAINST FALLOUT

In an area of heavy fallout the greatest radiological hazard is that of exposure to *external* radiation, which can be greatly reduced by simple precautionary measures. Exposure can be reduced by taking shelter and by simple decontamination measures. Test data indicates that the radiation level, i. e., the rate of exposure, indoors on the first floor of an ordinary frame house in a fallout area would be about one-half the level out of doors. Even greater protection would be afforded by a brick or stone house. Taking shelter in the basement of an average residence would reduce the radiation level to about one-tenth that experienced out of doors. Shelter in an old-fashioned cyclone cellar, with a covering of earth three feet thick, would reduce the radiation level to about 1/5000, or down to a level completely safe, in even the most heavily contaminated area. Designs of shelters of simple yet effective construction have been prepared by the Civil Defense Administration and are available to the public.

Radioactive material deposited during the fallout may or may not be visible but would be revealed by radiation detection instruments such as Geiger counters. Any falling dust or ash that can be seen down-wind within a few hours after a nuclear explosion should be regarded as radioative until measured by a radiation detection instrument.

Care should be taken to avoid the use of solid foods or liquids that may contain fallout particles.

If fallout particles come into contact with the skin, hair, or clothing, prompt decontamination precautions such as have been outlined by the Federal Civil Defense Administration will greatly reduce the danger. These include such simple measures as *thorough bathing of exposed parts of the body and a change of clothing.*

INTERNAL RADIATION EFFECTS

Two other factors must be considered in evaluating possible hazards from radioactive fallout. The first is the effect of internal radiation from fallout particles swallowed in food or liquids. The second is the effect of radiation upon the germ cells which transmit inherited characteristics from one generation to another. It should be noted that in neither case is there reason to believe that weapons testing programs of the United States have resulted in any serious public hazard.

The radioactive forms of strontium and iodine are the constituents of fallout which are of principal concern as internal sources of radiation through ingestion. The concentrations of these substances from

STATEMENT BY LEWIS L. STRAUSS, CHAIRMAN UNITED STATES ATOMIC ENERGY COMMISSION

At a news conference on December 17, 1954, I stated that the staff of the Atomic Energy Commission was studying the subject of fallout and expressed the hope that information about it would be made public at a later date. "Fallout" is the word now applied to a phenomenon that follows the explosion of a nuclear weapon. Such an explosion, if the fireball touches the surface of the earth, draws up large amounts of materials into the bomb cloud. These materials subsequently fall back to earth as radioactive particles over a large area, mostly down-wind and relatively close to the point of explosion—although the lighter particles are carried great distances. The main radioactivity of fall-out decreases very rapidly with time—for the most part, within the first hours after the explosion. An in-the-air explosion where the fireball does not touch the earth's surface does not produce any serious radiological fallout hazard.

Since nuclear weapons are in possession of the USSR, the Commission believes the American people wish to be informed regarding the dangers of nuclear explosions and the measures which individuals can take to protect themselves if an atomic attack should ever occur. Therefore, the Commission has condensed in the attached Report the information which can be made public at this time on the effects of the explosions of high-yield nuclear weapons.

The following excerpts and summarized sections contain the highlights of the Report itself.

FALLOUT PATTERN OF 1954 TEST IN THE PACIFIC

The very large thermonuclear device tested at Bikini Atoll on March 1, 1954, was detonated on a coral island and the ensuing fallout contaminated an elongated, cigar-shaped area extending approximately *220 statute miles down-wind and varying in width up to 40 miles.* In addition, there was a contaminated area up-wind and cross-wind extending possibly 20 miles from the point of detonation. Data was collected from 25 points on 5 atolls located from 10 to 330 miles down-wind (generally east) from Bikini Atoll. Due to an unexpected shift in the direction of the prevailing winds in the higher altitudes, the fallout missed the observation rafts that had been placed farther north

A REPORT BY THE UNITED STATES ATOMIC ENERGY COMMISSION ON THE EFFECTS OF HIGH-YIELD NUCLEAR EXPLOSIONS

1. Considerable information on the effects of the explosions of atomic weapons has been made public by the Government since the first nuclear detonations in 1945. The handbook, "The Effects of Atomic Weapons", published in 1950, is being revised and brought up to date to include the effects of thermonuclear weapons, as a result of the most recent tests at the Pacific Proving Grounds. References to the effects of thermonuclear explosions have been made in several official statements, beginning with Chairman Strauss' description of the phenomenon of "fallout" at a White House news conference on March 31, 1954. The following statement is designed to condense and correlate information, some of which already has been made public and other portions of which have been of a classified nature until now.

2. The effects of nuclear tests are evaluated for civil defense planning as well as for military and technological purposes. So long as nuclear weapons are in possession of any unfriendly power, the Commission believes the American public will wish to be as fully informed as possible as to the nature and extent of the dangers of nuclear attack and of the protective measures that can be taken by individuals and communities to avoid or minimize those dangers if we should be attacked.

3. Test conditions, which must necessarily form the principal basis of evaluating the effects of nuclear explosions, may differ markedly from those which might be expected if nuclear weapons were used against our population in wartime. It would be difficult to predict the size or kind of bomb an enemy might use against us in event of war, the exact means of its delivery, the height at which it would be exploded, or the number of bombs which might reach a given target. Nevertheless, the facts to follow are the fundamental ones at this time.

FOUR EFFECTS OF DETONATIONS

4. A nuclear detonation produces four major characteristics—blast, heat, immediate nuclear radiation, and residual radioactivity. Of these, the first three are essentially instantaneous, while the fourth has a more protracted effect. The phenomena of blast, heat, and nuclear radiation from the detonation of a thermonuclear bomb are

23. Thus, about 7,000 square miles of territory down-wind from the point of burst was so contaminated that survival *might* have depended upon prompt evacuation of the area or upon taking shelter and other protective measures.

24. At a distance of 220 miles or more down-wind, it is unlikely that any deaths would have occurred from radioactivity even if persons there had remained exposed up to 48 hours and had taken no safety measures.

25. The estimates cited above do not apply uniformly throughout the contaminated area inasmuch as the intensity of radioactivity within a region of heavy fallout will vary from point to point due to such factors as air currents, rain, snow, and other atmospheric conditions. Because of this and because most persons, if given sufficient warning, probably would evacuate the area or take shelter and other precautionary measures, the actual percentage of deaths could reasonably be presumed to be considerably *smaller* than these extreme estimates.

PROTECTION AGAINST FALLOUT

26. In an area of heavy fallout the greatest radiological hazard is that of exposure to *external* radiation. Simple precautionary measures can greatly reduce the hazard to life. Exposure can be reduced by taking shelter and by utilizing simple decontamination measures until such times as persons can leave the area. Test data indicate that the radiation level, i. e., the rate of exposure, indoors on the first floor of an ordinary frame house in a fallout area would be about one-half the level out of doors. Even greater protection would be afforded by a brick or stone house. Taking shelter in the basement of an average residence would reduce the radiation level to about one-tenth that experienced out of doors. Shelter in an old-fashioned cyclone cellar, with a covering of earth three feet thick, would reduce the radiation level to about 1/5000, or down to a level completely safe, in even the most heavily contaminated area. Designs of shelters of simple yet effective construction have been prepared by the Civil Defense Administration and are available to the public.

27. Radioactive material deposited during fallout may or may not be visible but would be revealed by radiation detection instruments such as Geiger counters. Any falling dust or ash that can be seen down-wind within a few hours after a nuclear explosion should be regarded as radioactive until measured by a radiation detection instrument and found to be harmless.

28. Care should be taken to avoid the use of solid foods or liquids that may contain fallout particles.

SUMMARY

42. The Atomic Energy Commission hopes that the information on nuclear weapons effects contained in the foregoing report will never be reflected in human experience as the result of war. However, until the possibility of an atomic attack is eliminated by a workable international plan for general disarmament, the study and evaluation of weapons effects and civil defense protection measures must be a necessary duty of our government.

43. Inevitably, a certain element of risk is involved in the testing of nuclear weapons, just as there is some risk in manufacturing conventional explosives or in transporting inflammable substances such as oil or gasoline on our streets and highways. The degree of risk must be balanced against the great importance of the test programs to the security of the nation and of the free world. However, the degree of hazard can be evaluated with considerable accuracy and test conditions can be controlled to hold it to a minimum. None of the extensive data collected from all tests shows that residual radioactivity is being concentrated in dangerous amounts anywhere in the world outside the testing areas.

44. In the event of war involving the use of atomic weapons, the fallout from large nuclear bombs exploded on or near the surface would create serious hazards to civilian populations in large areas outside the target zones. However, as mentioned in the foregoing Report, there are many simple and highly effective precautionary measures which must be taken by individuals to reduce casualties to a minimum outside the immediate area of complete or near-complete destruction by blast and heat. Many of these protective measures, such as shelter and decontamination procedures, have been detailed by the Federal Civil Defense Administration.

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ATOMS, NATURE, and MAN

Man-made Radioactivity in the Environment

by Neal O. Hines

CONTENTS

United States Atomic Energy Commission
Division of Technical Information
Library of Congress Catalog Card Number: 66-61322
1966

Survival of an Animal Population

Engebi Island, on Eniwetok's northeast reef, is the home of a wholly self-contained colony of Pacific rats living in a network of burrows in the shallow coral sands. After 1948 Engebi was exposed repeatedly to atomic detonations, and in 1952 the whole island was swept clean of growth and overwashed by waves from the thermonuclear explosion of Operation Ivy. On each of these occasions, exposure of the rat colony to radiation was intense. In 1952, by later estimates, the animals aboveground received radiation doses of 2500 to 6000 roentgens per hour, and those in burrows doses of 112 to 1112 roentgens per hour. The island environment was so altered by atomic forces and by contaminated water that radiobiologists believed it impossible that any of the rats had survived. Because there was no natural route by which the island could be repopulated, scientists even considered introducing a new rat colony for study of a population growth in a mildly radioactive environment.

Engebi Island, Eniwetok Atoll, home of a colony of rats living in radioactive surroundings. Close- up shows one burrow in the soil.

Contrary to all expectations, however, the original colony had not been eliminated. Biologists visiting Engebi in 1953 and 1954 found the rats apparently flourishing. New generations of rats were being born and were subsisting on grasses and other plants in an environment still slightly radioactive. In 1955 analysis of the bones of rats revealed the presence of strontium-89 and strontium-90 in amounts that would not cause bodily harm. The rats' muscle tissues contained radioactive cesium-137. But no physical malformations were found in the rats. All animals appeared in sound physical condition, despite these body burdens of radioactivity. By 1964 the rat population had so increased that it apparently had reached equilibrium with available

White-capped noddy tern nesting colony, Engebi Island, Eniwetok Atoll, photographed in 1965.

After 1951 each of the test programs had its radiobiological component. In the Pacific, radiobiological surveys were associated with Operation Ivy (1952), Operation Castle (1954), Operation Redwing (1956), and Operation Hardtack (1958). A small field station, the Eniwetok Marine Biology Laboratory, was established for use by scientists conducting biological studies. Bikini was incorporated into the Pacific Proving Ground in 1953, and new biological surveys were performed there in connection with the tests of 1954 and later.

A native rat, captured alive on Engebi Island

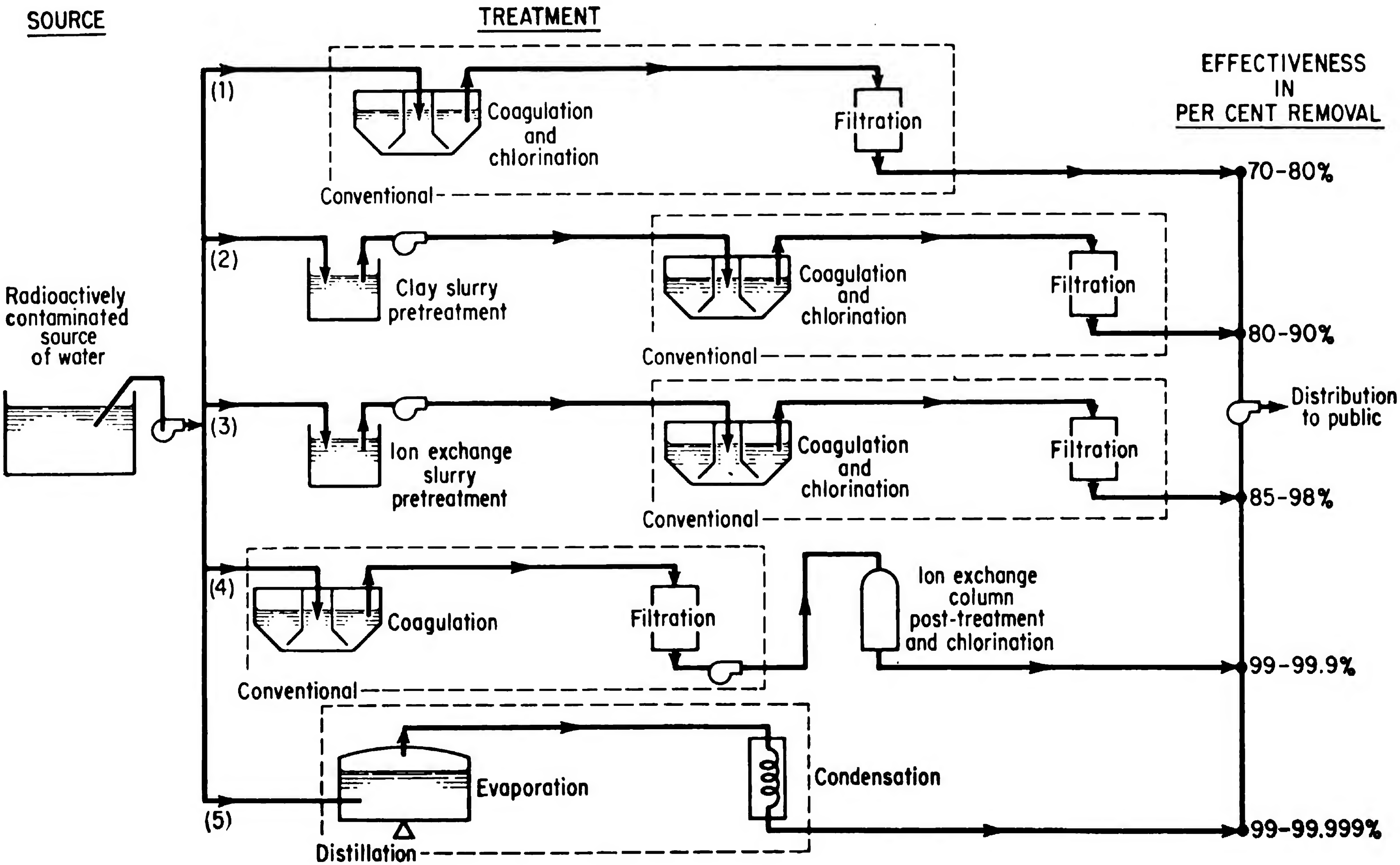
A thriving Messerschmidia *plant growing on Rongelap Atoll is studied for growth-rate and root-systems data after the island was accidentally subjected to radioactive fallout.*

School of surgeonfish off Arji Island, Bikini Atoll, August 1964. Note coral growth on lagoon bottom.

One of the last cows of the herd exposed to fallout by the world's first atomic detonation in New Mexico in July 1945, photographed in 1964. The calf is her 15th to be born in 15 years. The cow, believed about 20 years old, has been under observation by scientists, who found she suffered little apparent effect, although the fallout caused some hair to turn gray (see light patches on back). Other cows in the herd died natural deaths.

THE AUTHOR

NEAL O. HINES is an established writer and experienced academic administrator with an unusual background in radiobiological surveys of the Pacific Ocean atomic test sites. He holds degrees from Indiana and Northwestern Universities. A former journalism teacher at the University of California and Assistant to the President of the University of Washington, Mr. Hines also worked for a number of years with the Laboratory of Radiation Biology of the University of Washington, where he served from 1961-1963 as administrative assistant and as Executive Secretary of the Advisory Council on Nuclear Energy and Radiation for the State of Washington. He was a member of the survey teams visiting Bikini and Eniwetok in 1949 and 1956 and Christmas Island in 1962. His "Bikini Report" (*Scientific Monthly*, February 1951) was one of the earliest descriptions of radiobiological studies in the Pacific. He is the author of *Proving Ground* (University of Washington Press, 1962), a detailed history of radiobiological studies in the Pacific from 1946-1961.



The decontaminating effectiveness of various water-treatment processes. (*Lacy & Stangler*, 1962.)

William J. Lacy & Marlow J. Stangler, "The Postattack Water-Contamination Problem", Health Physics, v8, issue 4, August 1962